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The AUTOMOBILE

Vast Progress in Motor Design

Nearly All Engines of Recent Design Are Years Ahead of 1915 Models—Higher Pressures and Higher Speeds the Rule —Better Lubrication—Less Vibration— Greater Economy

By A. Ludlow Clayden

NEVER in the whole history of the automobile has the design of any part progressed so much in one year as has that of the American automobile engine during 1915. Owing to a variety of causes, change was forced upon the motor manufacturer and upon the automobile makers. The opportunity has been seized upon by engineers to let loose the pent up knowledge they had accumulated through the several years previous, so American engine design and construction has leaped forward in a year as far as Europe advanced in the previous three or four. From a position in the rear, in the engineering sense, the American motor has made a forced march to the van and stands alongside the best of foreign products.

Higher Speed

It is greatly to be regretted that the habit ever arose of estimating speed by revolutions per minute. The speed that counts in an engine is the speed of piston movement in feet per minute and it is easier to get high crankshaft speed than high piston speed. On a 3-in. stroke 3000 r.p.m. means just the same piston speed as does 1500 r.p.m. for a 6-in. stroke, so there is little sense in calling the former a high speed and the latter a slow speed engine.

Similarly, horsepower ought to be plotted against piston speed rather than against revolutions, and the quality of the engineering in a motor is better judged by a curve of brake-mean-effective-pressure plotted against piston speed, than it is by any ordinary power curve plotted to revolutions. Of course, both curves show the same forces and velocities in different forms of expression, but the ηp-piston speed curves are at a glance, indicative of the relative quality of two motors while the hp.-r.p.m. curves are not.

Still, however the plotting is done, the fact remains that piston speeds have risen enormously this year, and in conjunction gas speeds through valves and passages. Simultaneously, modern motors are expected to operate at slower speeds than formerly, so the total range of speed has been widened at both ends. This has made things distinctly difficult for carbureter makers, but they have risen to the occasion very well.

Demands of User Complex

The automobile engineer has this year been asked to give the following new features to his engine:

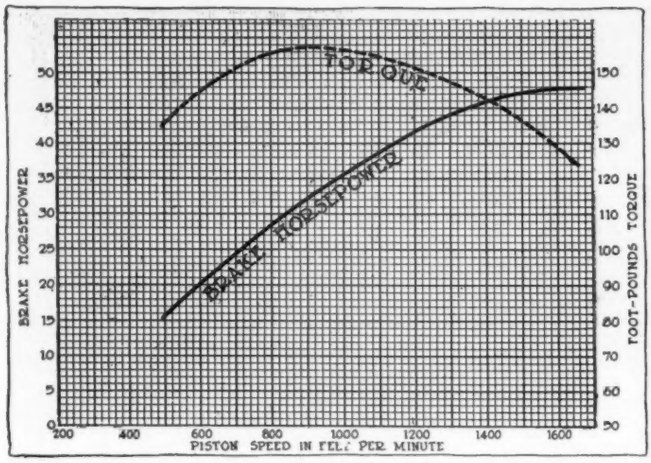
- Higher maximum speed.
- Lower minimum speed.
- More power at all speeds.
- Greater quietness.
- Better gasoline economy.
- Lighter weight.
- Less vibration.
- Better oil economy.
- Smoother torque.
- Cheaper construction.

These make up a fairly formidable array of problems.

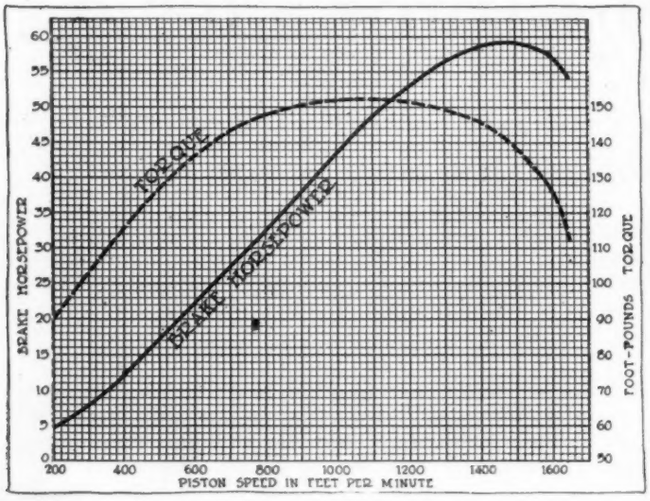
To get the nearest approach to satisfaction of all these demands there has been produced:

- The eight.
- The twelve.
- The aluminum piston.
- The aluminum cylinder.
- Larger crankshafts.
- Higher pressure lubrication.
- Higher compression.
- Larger valves.
- More elaborate cams.
- Simplified gas passages.
- Greater rigidity.
- Less machining.
- New machine tools.

Much credit for the progress made belongs to the machine shop men, the factory superintendents and tool designers



Power and torque curves for the Continental light six, 3½ by 5 in.



Power and torque curves for the Ferro eight, 3¼ by 4 in.

whose names never reach the automobile public. Without the able support and help of these men the automobile engineers would have been handicapped heavily, for the all important requirement of inexpensive manufacture would have been impossible to combine with better performance.

Overhead Valve Position Speculative

Before descending into detail on what has been done, there are a few trends which should be noticed. A conspicuous one is that toward the overhead valve and this is likely to persist. The old idea that an overhead valve is essentially noisy is exploded utterly, the present trouble in the main is to control the lubrication of rockers and parts above the cylinders without flooding the valves themselves.

Intimately bound up with the overhead valve is the detachable cylinder head that is returning to popularity, both for cheap motors and engines of the very highest class. Whatever the type of valve, the detachable head is a great advantage to the car owner, because it renders carbon removal and valve grinding far easier than with any one-piece L- or T-head motor. It is a manufacturing advantage with most designs, and there is now no difficulty in replacing a head so that the water and gas joints are tight. Probably less leakage occurs with the detachable cylinder head than normally is found around the valve plugs in the other type.

Given the detachable head and the necessity for valve cages disappears, and it is the cage that has been liable to give most trouble in overhead valve motors.

Cages are satisfactory if the volumetric efficiency is not very high, but as soon as pressures and temperatures rise there occurs trouble in cooling the valve cage seating and danger of cracking the cage. It is only on racing motors that valves with seats in a non-detachable cylinder head are permissible, because valve grinding under such conditions is almost a factory job, as was found by the Hispano-Suiza Co. with a model of car that cost them much trouble and distress two years ago.

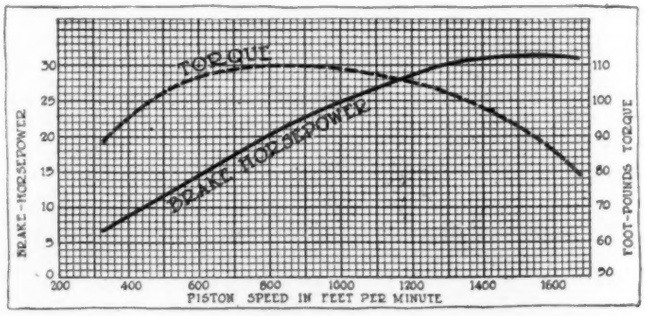
Overhead Camshaft Not Popular

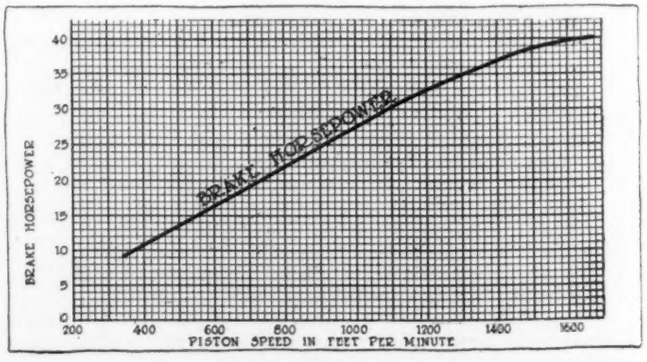
While it becomes universal for racing, the overhead camshaft is not too attractive for touring car engines, because a quiet drive is difficult of attainment and lubrication is rather complicated. With the camshaft in the usual place and long, light push rods, it is now easy to design an enclosed rocker mechanism which will be self-lubricating without a pump feed, and the final arrangement will be more accessible than any overhead camshaft job.

Of course the overhead shaft is comparatively new and development may easily show some scheme for simplification. The present situation is that the overhead valve presents no specially difficult problems, while the overhead camshaft still does. The self-lubricating bushing in which graphite is used as a part of the bearing surface has been applied successfully to the rockers of overhead valves and this needs little, if any, oil to keep it in good condition. Also there is the spherical end type of rocker like that used on the Brush engines, which contains its oil and uses all the lubricant without waste. The main reason for the overhead camshaft is to reduce to the minimum the reciprocating weight of the valve operating parts. For an engine to be used in a touring car the lightness obtainable by employment of an overhead camshaft is not *yet* necessary, wherefore it is more likely that overhead valve development will be mainly in connection with camshafts in the crankcase position.

Chain Drive Camshafts Slow

The chain-driven camshaft has not developed to the extent expected, and the reason is mainly that manufacturers have been loath to spend enough to insure good chain. Good chain is expensive to make and cannot be sold cheaply, and there are only a very few firms in the world who can make really

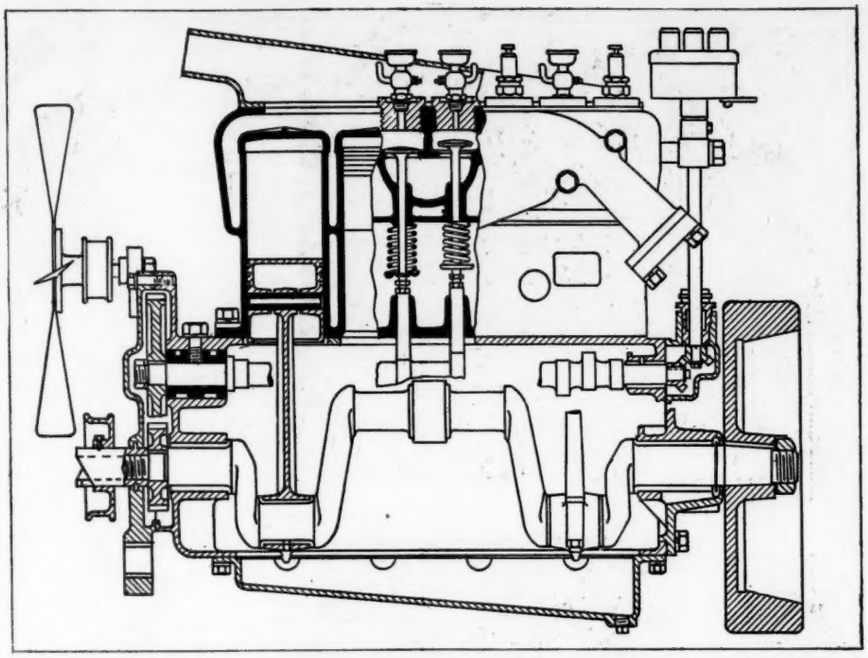




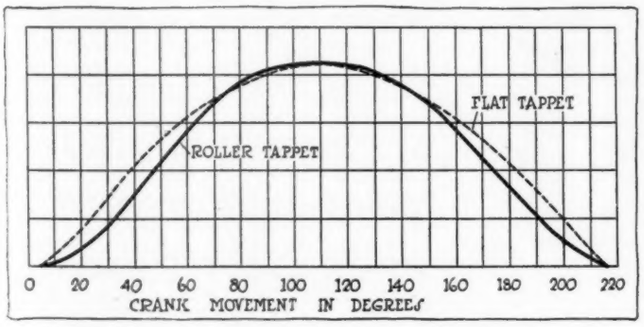
Power and torque curves for Northway four, 3½ by 5 in. and power curve for Rutenber eight size 3 by 5 in.

good chain. Also, the application of a chain drive needs expert knowledge and automobile designers have often used chain in a way that no chain maker would approve. In such cases failure is usually blamed on the chain, which is totally unjust.

On the other hand, those few people who have used chain intelligently are extremely pleased with the result, and especially comment should be made on the success of the Packard-Morse automatic adjustment. It will be remembered that the Packard twin six has a triangular chain drive and that the sprocket which drives the pump and the generator contains within it an Oldham coupling which is in permanent operation. This coupling has taper tongues and this prevents the development of slack, while spring pressure takes up what little wear may occur. The device is simple, and has proved thoroughly effective, it is an American idea used with American chain and the results are better than the average attained with imported chain which was the most reliable sort in the first attempts made by motor builders at chain layout.



The Perkins four; a well-known small engine of great simplicity and featured by the small number of parts. Several sizes are made of correspondingly clean design



Comparative valve diagrams for roller and mushroom tappets

TABLE I

Port Diam.	Beneath Valve Area	Equivalent Flat	Valve Lift For— 30°	45°
1	0.785	0.25	0.26	0.35
1 1/16	0.886	0.26	0.27	0.37
1 ⅛	0.994	0.28	0.29	0.39
1 3/16	1.107	0.29	0.31	0.42
1 ¼	1.227	0.31	0.32	0.44
1 5/16	1.353	0.33	0.34	0.46
1 ⅜	1.485	0.34	0.36	0.48
1 7/16	1.623	0.35	0.37	0.51
1 ½	1.767	0.37	0.39	0.53
1 9/16	1.917	0.39	0.40	0.55
1 ⅝	2.074	0.40	0.42	0.57
1 11/16	2.236	0.42	0.44	0.59
1 ¾	2.405	0.44	0.45	0.62
1 13/16	2.580	0.45	0.47	0.64
1 ⅞	2.761	0.47	0.48	0.66
1 15/16	2.948	0.48	0.50	0.68
2	3.142	0.50	0.52	0.70
2 1/16	3.338	0.51	0.53	0.73
2 ⅛	3.546	0.53	0.55	0.75
2 3/16	3.758	0.55	0.56	0.77
2 ¼	3.976	0.56	0.58	0.79
2 5/16	4.200	0.58	0.60	0.81
2 ⅜	4.430	0.59	0.61	0.84
2 7/16	4.707	0.61	0.63	0.87
2 ½	4.909	0.62	0.65	0.88

Where gears are used for camshaft driving it is often found that a chain is used for the generator shaft. That is an anomaly which cannot endure and it is reasonable to expect that the complete adoption of chain driving will follow.

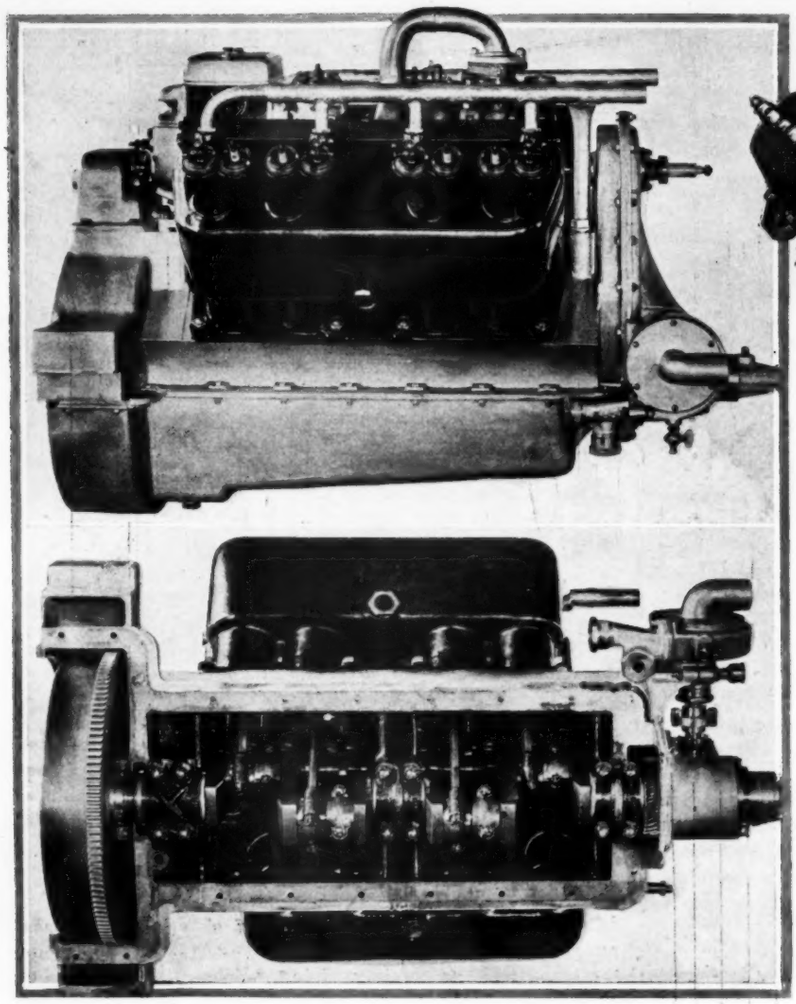
Aluminum Pistons Arrive

After years of experiment, years of skepticism, the aluminum alloy piston has been accepted and bids fair to become the standard. The rapidly rising price of aluminum has retarded this development, but despite the high price aluminum pistons are now fitted to motors on quite cheap automobiles. The aluminum piston, weight for weight and strength for strength, is the cheapest type. The light weight is necessary because of high piston speeds and it is cheaper to obtain it by using aluminum than by elaborately careful machining of iron or steel. There is less machining on an aluminum piston than on any other type, and it is easier machining too. Between die-cast and sand-cast pistons and pistons cast by a combined process part die and part sand, much argument remains which time alone will settle. It must be remembered, however, that die-casting is still in its infancy, while sand casting is not and the tendency is towards die-casting. It may prove to be but a temporary trend, but that it should so do seems improbable.

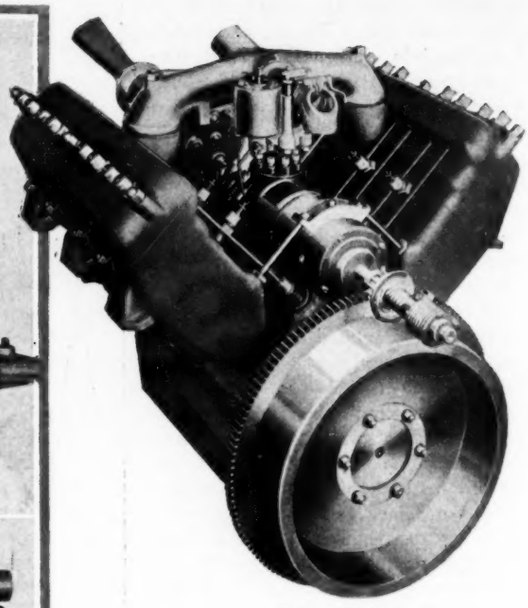
Aluminum Cylinders on Trial

In the race for lightness, the aluminum motor makes its debut as a standard product on one 1916 car alone. Naturally this is a high-priced car, for aluminum cylinders are out of reach of the cheap car maker with the metal at its present price. During 1915 something like fifty cars have been in use with aluminum cylinders, and none have given trouble on this account. Each automobile was some 80 to 120 lb. lighter on this account and so great a saving is well worth a small price increase. Development along this line depends entirely on the price of aluminum; should this fall the aluminum motor will become common very rapidly, but if it rises the day of aluminum cylinders will be postponed. At present that is all there is to be said.

A gear ratio of 4.5 to 1 on high gear means a crankshaft speed of 2000 r.p.m. at 50 m.p.h. approximately. Again

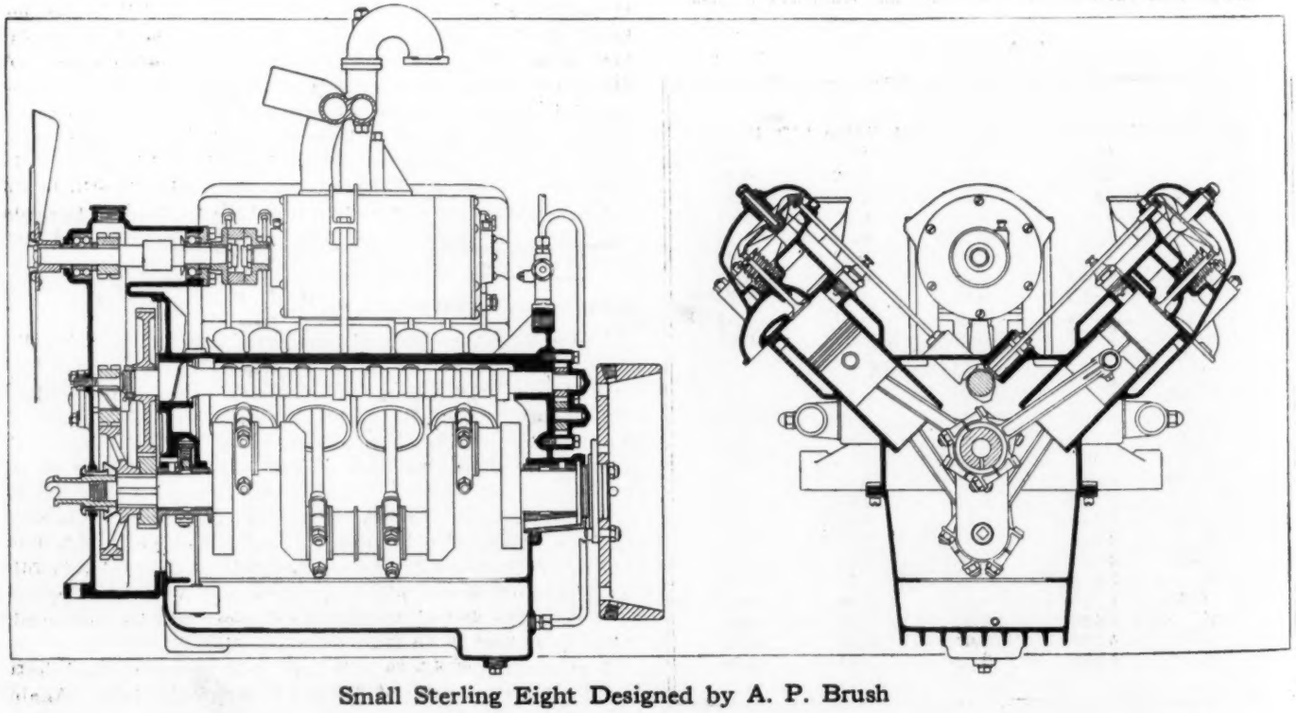


Herschell-Spillman Eight

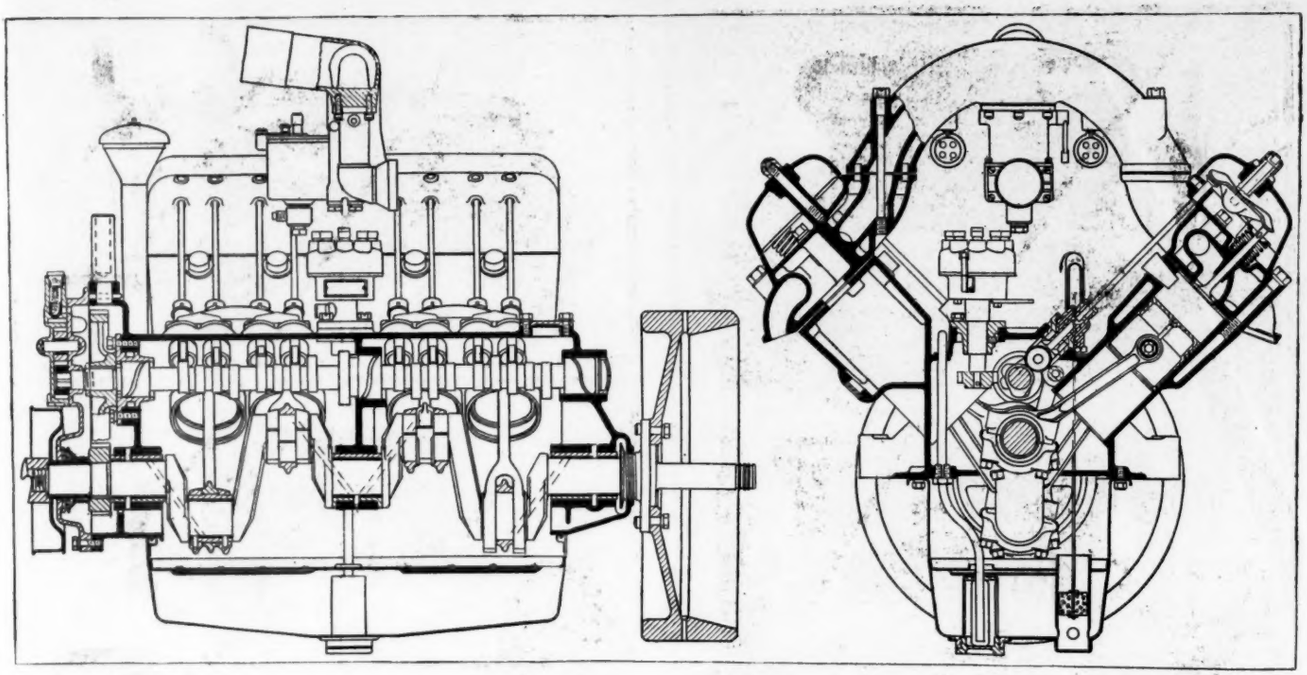


Ferro Eight

SIX DIFFERENT EXAMPLES OF V-TYPE EIGHT CYLINDER MOTORS ILLUSTRATING ALL PRINCIPLES OF DESIGN

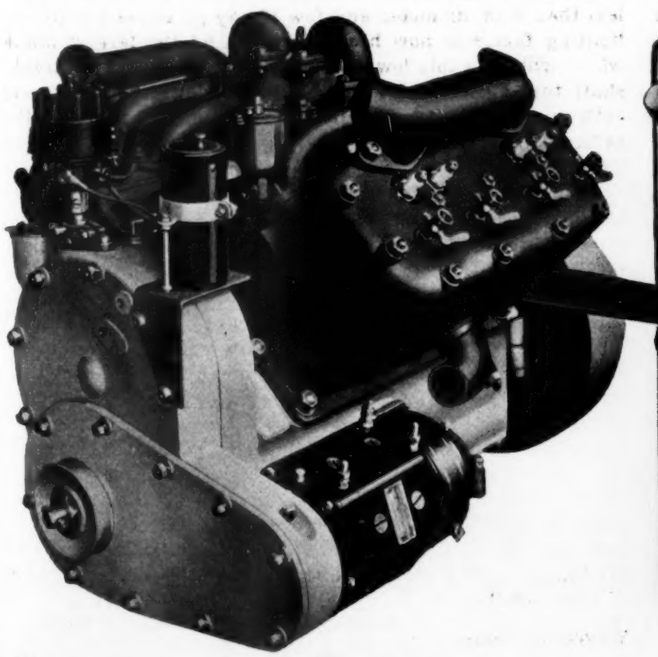


Small Sterling Eight Designed by A. P. Brush

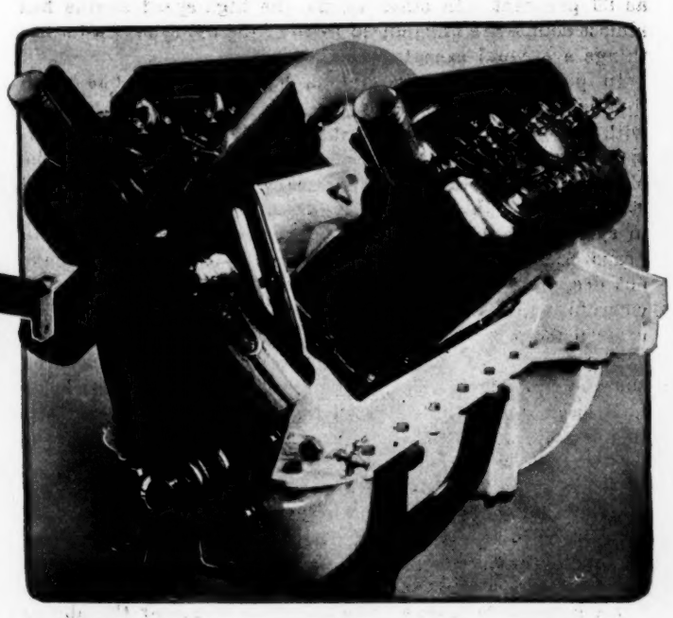


A contrast in eights is provided by a Herschell-Spillman on the left of page 824 seen from the side and from beneath, and the Ferro beside it. The former is an L head motor and has the side by side connecting rod arrangement, while the latter is provided with the most up-to-date idea in overhead valves and use the forked connecting rod system. The great rigidity of the bearing support in the Herschell-Spillman motor is observable. The bearings in this motor are finished by an unique burnishing process. Connecting-rod bearings can be taken up just as for any other type of motor. At the bottom left of this page is the Port Huron eight, which is distinctive by having the camshaft very high up. The valves are inclined at an angle of 135 degrees, which enables one cam to be used for each opposing pair of valves with straight push rods and no rockers. Detachable cylinder heads make the valve heads accessible and the wide angle brings the tappets into a position where they can be reached without as much trouble as usual in L head eights. Beside it is the Buda eight, a robust motor with all the characteristics of high quality workmanship that have given the Buda fours and sixes their reputation for long, trouble-free service.

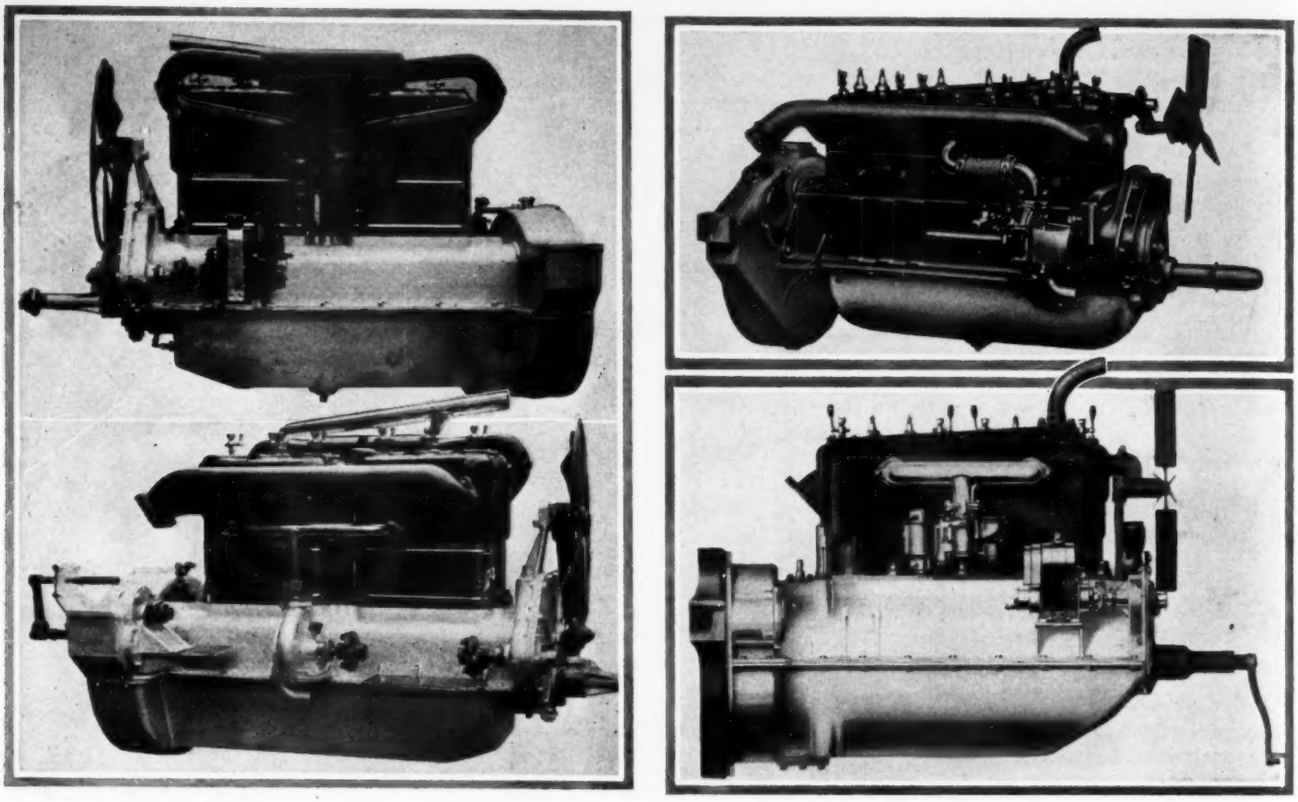
The drawings show two examples of the eights designed by A. P. Brush. That on this page is the Ferro and that on the page opposite is the Sterling. They have many points of similarity, of which the principal one is the overhead valves, the special type of rocker operation, and the casting of the two blocks of cylinders in one piece with the upper half of the crankcase. As can be seen in the cross sections, the rockers seat on ball shaped bolt heads instead of on the ordinary pin joint, and this facilitates adjustment because the bolt can be screwed down a little from outside the motor, so lowering the whole rocker and taking up any slack. Points of difference are that the Ferro, which is the larger, uses three crankshaft bearings and forked connecting rods, while the Sterling has the other kind of rod and only two crankshaft bearings



Port Huron Eight



The Buda Eight



These are three typical and different motors. On the left two views of the Herschell-Spillman six, a large and powerful T head design. The intake is a Herschell-Spillman specialty. Excellent accessibility is a conspicuous feature as can be seen by the ample space round every part. Top right is the popular Continental light six, a new motor this year. It has a one-piece cylinder block and crankcase upper half and is 3½ by 5. The oil pump is a plunger, driven off the camshaft and so very accessible, while valve accessibility is assured by the detachable cylinder head. Right lower, is quite a different sort again, being a heavy duty Wisconsin four. This is the only motor in the group with an L head cylinder and it may be seen that the carbureter and magneto are very easy of access

approximately, this gives a piston speed of 1700 ft. per minute at 50 m.p.h. or 70 per cent above the speed on which the formula horsepower is based, if we assume an engine with the extremely popular stroke of 5 in. This increases the amount of any unbalanced force, or the pressure on the bearings due to inertia of the reciprocating masses as much as 89 per cent. In other words, the high-speed engine has almost double the unbalanced force of the old type if all other things are equal except gear ratio.

In practice, of course, the high-speed engine has much lighter parts, and therefore is able to run at high speed with no greater vibratory stresses than the larger slow-speed motor, but the public have not been satisfied with the old type; so it has been necessary to reduce unbalanced stresses below the old level simultaneously with an increase in speed. Increasing the speed increases vibratory stress in proportion to the square of the speed and dimensions have not decreased in proportion to the square root of anything, wherefore much higher engineering quality is necessary in modern motors.

The weight of reciprocating masses has been reduced enormously, size for size, and pressure on bearings reduced likewise, so that the balanced and unbalanced stresses due to the reciprocating masses in a 1916 engine may easily be less than in a 1915 engine of the same piston displacement. Multiple cylinders reduce the unbalanced forces by reducing individual piston weights, and higher speed sixes have allowed dimensions to be cut and weight reduced in proportion. With any motor having more than four cylinders it has been the balanced forces that have proved most troublesome.

An automobile engine is balanced by virtue of the ability of the crankshaft to hold adjacent pistons so truly in relative positions that the unbalanced forces due to the pistons individually cancel out. As the stresses increase in proportion to the square of the speed the strength of the crankshaft has been forced up likewise, and thus we see cranks on motors of 3 in. bore now often of well over 2 in. diameter. This vibration question has destroyed any idea that may have existed as to proportion between bore, stroke and crank diameter. In practice few modern motors have crankshafts less than 2 in. diameter and few if any go above 2½ in. the limiting factor is now bearing speed and the largest crank which will keep this low enough is employed. A 2-in. crankshaft turning at 3000 r.p.m. has a bearing speed of nearly 1600 ft. per minute, and 1800 ft. per minute is above the safety limit for ordinary bearing materials and ordinary lubrication.

Though it has so far appeared on one car only, the use of the Lanchester damper for eliminating the effect of torsional vibration from crankshafts marks a stage in development, because it belongs to a class of fitting hitherto considered "uncommercial." There are now so many motors which run without perceptible vibration up to road speeds of 40 m.p.h. or over that the automobile user is going to get extremely critical. For this reason it is safe to predict that the moderately large number of coarse running, roughly made engines still manufactured are entering their last season.

Cheaper cars and better equipped cars has been the cry for many years and the leaders of industry have stood still on engineering quality. Now, engineering quality is improving rapidly in the more costly cars and the cheaper field is following fast. Nineteen hundred and sixteen has marked the beginning of a change which will take three or four years to consummate.

Valves Are Larger

In Europe two years ago, it was obvious that the stock motor makers had picked upon a valve diameter equal to half

the cylinder bore as the practical maximum, and large valves with a small lift were used generally because this combination gave the greatest opening with the least noise. To-day the best American engines have valves of just about this same proportion and it is customary to find the lift is such that the full port area is available at maximum opening. Table 1 shows the lift of valves with flat and angular seats to give maximum opening for 1 in. to 2½ in. ports.

Now, maximum lift and large diameter is not all that requires consideration for the important thing from the viewpoint of volumetric efficiency is the average valve opening during the cycle. The constant acceleration cam profile is usually considered the ideal, but it is worked to very seldom, because to form a cam of this character calls for very delicate machining and the use of grinding wheels which have a very short life. The flat sided cam gives commercially good results on moderately priced jobs, but the fact that the more elaborate profile is really much better offers a great opportunity to the ingenuity of the machine tool trade. There is a huge field for a robust cam-grinding tool which will produce small, constant acceleration cams at reasonable cost.

Quietness of valve operation has been shown to be affected greatly by the weight of the tappets, and a light tappet enables a lighter valve spring to be used. Everything which will reduce the inertia of the valve, tappet and valve spring is desirable. It is the search for quietness that has caused the roller ended tappet to gain in favor, for a slightly better diagram is obtainable with the mushroom type, when a flat side cam is used. Curves on page 823 show characteristic diagrams for cams of different forms with differing tappets.

It must be remembered, however, that the diagram obtained at high speed may differ greatly from the theoretical, as the tappet has a tendency to "float" and actually does so as a rule at speeds exceeding 1500 r.p.m. In this connection it is claimed that there is advantage in using two light springs instead of a single heavy one, the theory being that all springs have a certain amount of hysterisis and that this is lower in the case of two small concentric springs than in one large spring of heavier section. This is by the way, however, as there is no stock motor yet in which two springs are used on each valve.

Lubrication a Difficulty

With the coming of higher piston speeds lubrication has become troublesome. Particularly in engines with many small cylinders, where the total piston periphery is large in proportion to the piston displacement, there has been a tendency for water to deposit in the crankcase and this has given great distress to several manufacturers. The reason is that the loose pistons deemed necessary for high speeds have allowed products of combustion to pass freely at low speeds, and the water from these products has condensed. Hence the efforts of V motor makers have been rather to insure the presence of plenty of oil in the cylinders than otherwise. The trouble is new this year, and is serious, because the water has a terribly destructive effect.

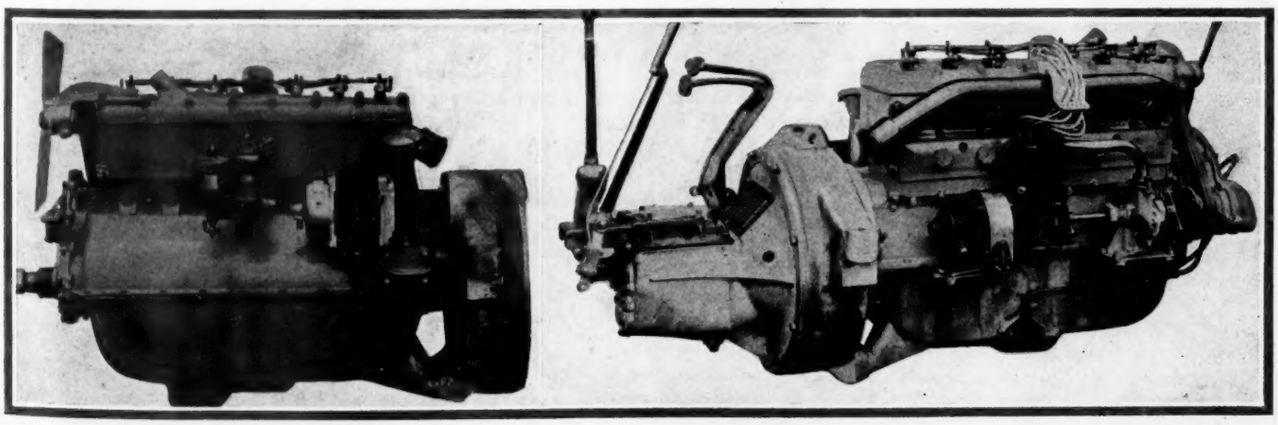
To overcome it, for it has been overcome, pistons have been tightened a little and bottom rings or V shaped "lifting" grooves have been put in the piston skirt. None the less the user of a new car may find it worth while to change the oil a little more often than he had to do with older cars.

The most striking development of lubrication has been the coming of the pressure system. This has gained steadily for years, but has been regarded as complicated for some mysterious reason. A splash system needs a pump to maintain constant level, crankshaft bearings will wear longer in proportion to the pressure of the oil entering them, to join the pump to the bearings by direct pipes is *simpler* and just as cheap as to make gutters and pockets to catch splashed oil. Hence to call pressure feed to the main bearings complicated is absurd.

Then for the crankpins, what could be simpler than a drilled crankshaft? It costs more than the dip troughs, but a hole through a shaft is less complicated than a system of troughs and feed pipes and guides and splashers. Say that the pressure system is more expensive, and the case is unarguable, but the extra cost is not great and the extra life of bearings, in a high-speed engine, is very great. Any engine that has a good bearing life with splash oiling will have a longer life with pressure oil. This being realized by the engineering leaders of design, we see many more motors appearing with the best system.

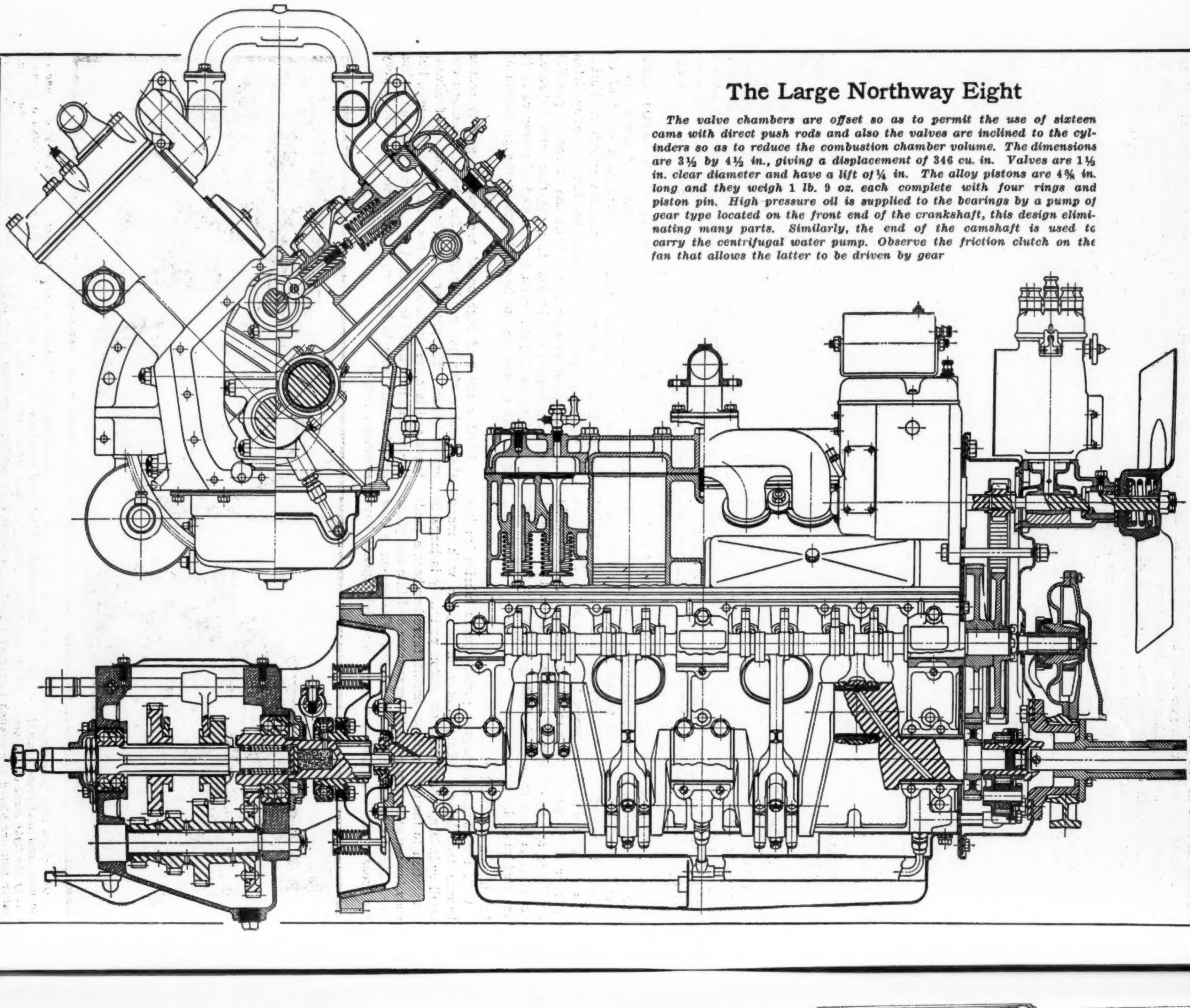
A drawback to high-pressure oil which caused much trouble in European development was that there exudes from the ends of the crankshaft bearings a whirl of oil spray which has a tendency to soak the cylinders. Fortunately for the American engineers, the aluminum alloy piston can be made of greater length than the European practice without increased weight and this, together with improved means for scraping the walls, has enabled oil pressures up to 50 lb. per square inch to be used without the production of smoke.

Another effect of high speed has been to greatly reduce the number of plunger oil pumps, for the gear pattern operates better. The plunger pump has a number of advantages and is more positive than the gear at slow speeds, but like valves, it is liable to float at high revolutions and unless operated positively in both directions when it becomes very expensive indeed.

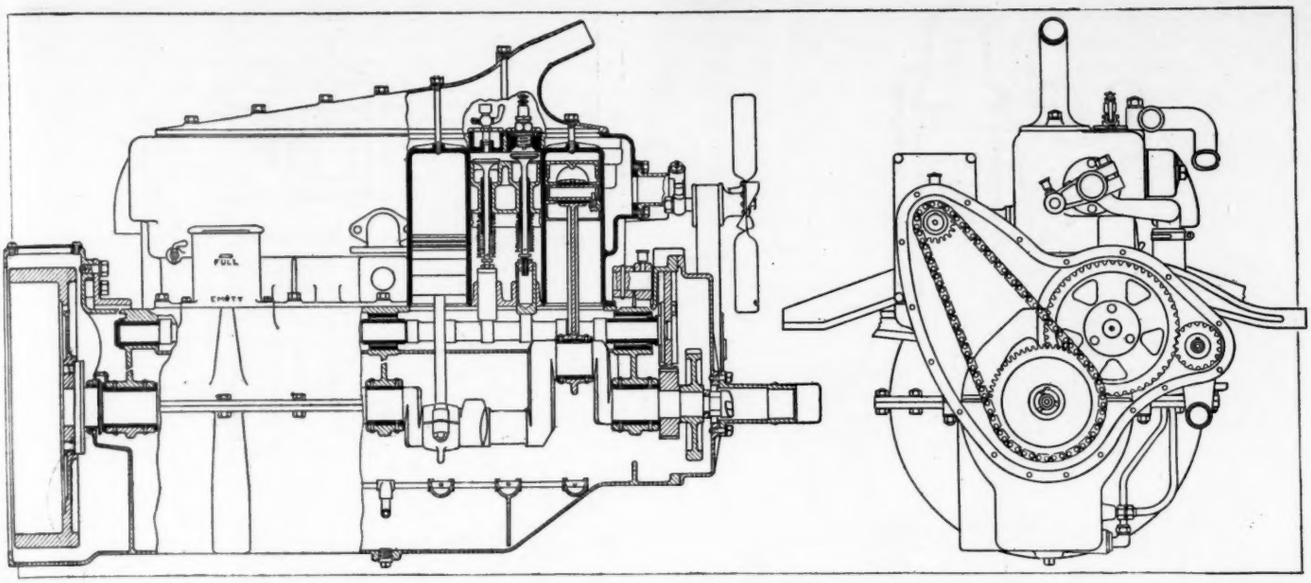


One of the most popular of the light sixes, and one of the most successful, the Rutenber 3 by 5-in. motor. This engine is one of the most neat and clean examples of the one-piece cylinder block and crankcase variety, and has the extra credit of being a pioneer among the light sixes of the year. All the intake manifolding is done within the casting, and the water pump with the generator and igniter unit are placed low enough to render tappet adjustment easy without removing more than the cover plate. A peculiarity is the use of a vane pump situated on the extreme front end of the cam-shaft for oil circulation, this also being very accessible

The Large Northway Eight



The valve chambers are offset so as to permit the use of sixteen cams with direct push rods and also the valves are inclined to the cylinders so as to reduce the combustion chamber volume. The dimensions are 3½ by 4½ in., giving a displacement of 346 cu. in. Valves are 1½ in. clear diameter and have a lift of ¼ in. The alloy pistons are 4⅜ in. long and they weigh 1 lb. 9 oz. each complete with four rings and piston pin. High pressure oil is supplied to the bearings by a pump of gear type located on the front end of the crankshaft, this design eliminating many parts. Similarly, the end of the camshaft is used to carry the centrifugal water pump. Observe the friction clutch on the fan that allows the latter to be driven by gear



A typical example of modern high-efficiency six-cylinder design is the Model motor made by the Pittsburgh Model Engine Co. The dimensions are 3 by 5 in., giving a piston displacement of 212 cu. in. The pistons are light iron castings and the crankshaft 1¾ in. diameter with three bearings. It will be noticed that the piston pin is fixed to the piston, a practice that is gaining favor. The valves are 1⅝ in. diameter with ¼ in. lift and the tappets are of light, hollow section with flat heads. In the front end gears are used for the camshaft drive and an adjustable chain for the generator drive

It is good to see that a few pioneers are taking up the matter of controlled oil supply and varying the pressure to the speed, or to the effort of the motor. This is absolutely rational as it saves oil and maintains the oil pressure in proportion to bearing load.

Stock Motor Lubrication

In stock motors, such as are most commonly used in cars built on the assembly system, the lubrication is almost universally by dip troughs in combination with separate leads to the main crankshaft bearings. A few motors have drilled crankshafts, but they are rare and not used on many cars. At one time a very popular stock motor system was to feed the dip troughs from an oil tank by an automatic "vacuum" air entering through a hole in the bottom of the tank when the level in the crankcase fell far enough and allowing a few drops of oil to escape. This was a fairly good system and did away with the pump, but it is not so accurate as pump filling for the troughs and is seldom used to-day.

With very few exceptions, where plunger pumps are employed, they are driven from an extra cam on the camshaft, the plunger being lifted by the cam and depressed on the suction stroke by a spring. Where there is a gear pump it is most often located in the crankcase and driven by a special vertical shaft off the camshaft. Of course the plunger is cheaper and it is just as good for speeds up to 1800 r.p.m. or a little over. It also has the advantage that it is easily accessible for cleaning.

In all motors almost, whether stock or special, there is room for improvement in the means provided for removing the filtering screen, but it is noteworthy that the 1916 stock motors are generally better provided with screening gauzes. Higher crankshaft speeds call for more perfect oil, as well as for better distribution of that oil.

Lubrication of Eights

When the Cadillac eight made its first appearance on the drafting board it was already the intention to make it a high-efficiency motor, to use high-working pressures and high-bearing pressures. Thus it was designed with a full pressure lubrication system as had been common on high-class fours and sixes abroad.

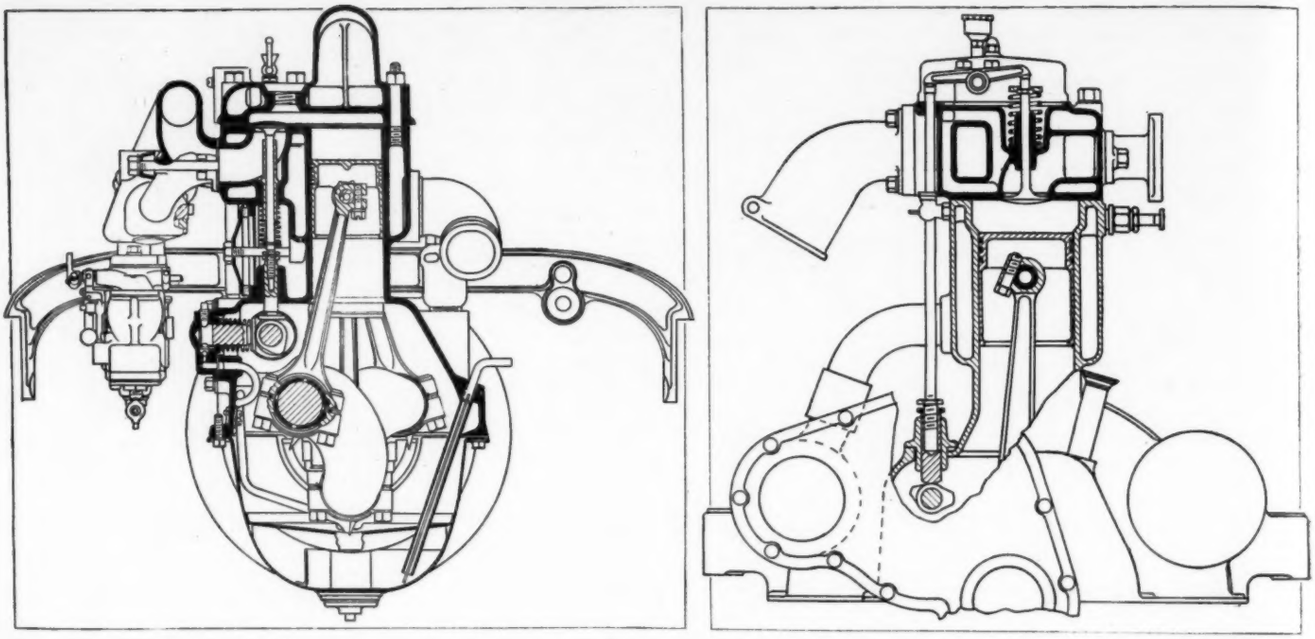
As the other eights appeared the desire to make them highly efficient as well as novel, persisted, so other designers and engineers turned to the pressure system, naturally. There then arose an impression that the eight *had* to have a pressure oiling system, for some mysterious reason, though this is not necessarily true. The fact is that to drill the simple four-cylinder crankshaft for internal oiling is much less expensive than to perform the same operation for a six, so the better system could be used without extravagance. Also the lower end bearings of the connecting-rods of the various patterns were all experimental to some extent, and the manufacturers felt safer with oiling that could not fail. Experience suggests that, if the maximum speed is not too high, trough oiling is quite practical for eights or even twelves. There has been remarkably little trouble with V-motors due to one set of cylinders getting more oil than the opposite set, as was anticipated at first, and it is quite possible that the absence of dip troughs has helped in this respect.

Effect of Eight on Other Types

This year has seen almost every engineer more interested in the V-motor than in anything else, so we often find that a big motor manufacturer has made his eight the principal new model, embodying most improvements, and has left the remainder of his product fairly well alone. The high pressures of the new eights have not caused trouble, the lubrication systems have worked out well and so on; wherefore it is to be expected that next year will show us various high-pressure, high-efficiency sixes and fours in which the experience gained with the eight will show up.

The tendency in this direction is shown by the various light sixes, which are designed to run up to speeds of 2000 to 2500 r.p.m. and are proving not only lighter, but actually more powerful than the older, larger motors. The light six stock motor is now to be found in the range of almost every manufacturer. Usually it is also an inexpensive engine, so in making it a great many desirable things have been combined.

Fours are so often made solely for cheapness that the efficiency enthusiasm has not yet put its mark upon stock motors of this number of cylinders. Here and there new designs have valves made larger, bearings bigger and everything stiffer, to permit increased revolutions, but the movement which is well advanced in the eights and is started and on



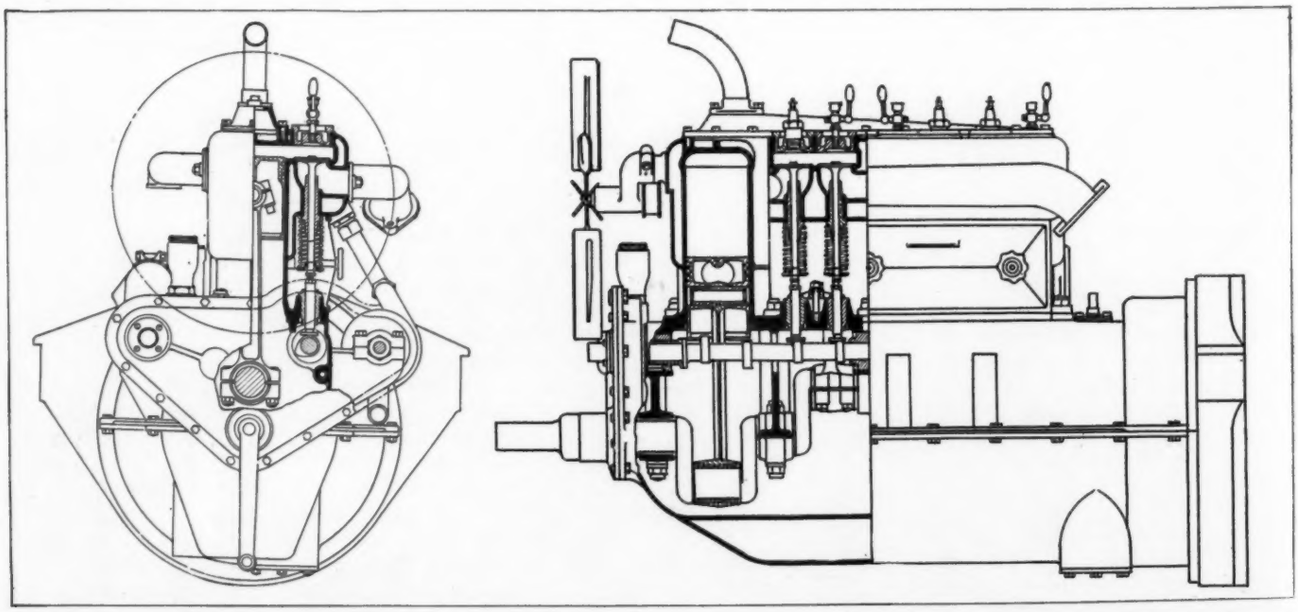
Left—One of the smallest and most widely used sizes is the Continental power plant of the little Saxon car. Note that the oil pump is operated off one of the exhaust cams and that there is a detachable cylinder head. Large waterways and free gas passages are also characteristics. Right—Section through the cylinder head and valve gear of a Falls motor cut through one of the exhaust valves. This section is instructive because it shows the way the intake manifold is carried through the water jacket on the head block, this being the inner rectangular black section just to the left of the valve

its way with the sixes is only to be observed in the stock fours by very close observation.

Water-Cooling Innovations

For circulating cooling water the centrifugal pump still is king. Thermo-syphon cooling gains slowly, but it does seem to be specially applicable to V-engines, because the low altitude of the latter allows a good head of water in the radiator and a good head is the life and soul of a successful syphon system of circulation. The thermostat, for controlling the flow of water in the circuit, has been perfectly satisfactory, but so also have systems without a thermostat. Probably the most correct view would be to say that the thermostat is a refinement which aids carburetion, especially in cold weather, but is an item of cost the moderate-priced car can afford to do without.

The most striking thing about water systems is not to be observed from outside a motor and seldom to be appreciated from sectional drawings, as it is the increased amount of water space allowed around the valve ports and pockets. In raising the efficiency of an engine the valves soon suffer if they are not well cooled, and also, which is more important to the average owner, if the valves are overheated and their accuracy of closing injured, slow running becomes uncertain.



Though primarily a heavy duty motor this example of Wisconsin manufacture is typical in outline. The four crankshaft bearings are a peculiarity which is favored by the Wisconsin engineers and give an exceptionally firm support for a four-cylinder crankshaft. The crankcase is all aluminum and lubrication is by pressure. Notice the very large water spaces behind the valve pockets, between the valves and the cylinders, also the light mushroom headed tappets. Slender valves are also a striking characteristic of this engine

It has been remarked that carbureter makers are being called upon to supply instruments which will give gas at very low speeds, and to do this a steady suction is imperative. If the valves are not functioning perfectly the suction will vary and the carburetion be upset. Hence, it is rendered doubly important that the valves should be in the best possible condition all the time.

Materials of Construction

The materials used for engine parts have undergone some change but not a great deal. The rising price of aluminum has rather encouraged the use of iron for the upper half of the crankcase, as instanced by several of the light sixes, and the popularity of the detachable head has helped this system of construction because it simplifies the foundry work. Casting an L-head motor with crankcase and cylinders in one with a fixed head is difficult because the cores become rather complex, but with the loose head the casting is easier than for an L-head cylinder block without the crankcase portion.

Probably, when the price of aluminum falls again, it will find the readiest application to cylinder casting by straight replacement of the all-iron designs, as the casting advantage is more than ever valuable with the lighter metal.

Steel as used for crankshafts is usually of about the same strength and character as that employed last year, as the upward trend in size of shaft enables more than enough strength to be obtained without the use of very high tensile material.

For valves tungsten steel would have been the rule, had the supply of the tungsten ore not been almost cut off by the war. Cast-iron heads welded to steel stems are still fairly popular, but are giving way slowly before the improved valve steels which mostly have tungsten as an element. The valve steel which gives best service in a high duty motor has some resemblance to the high speed steels that are most durable for cutting tools on high-speed machines.

Piston Valve Motor Provides Compressed Air

A NEW engine which has several features of interest including a device for air braking has been recently patented by E. U. Stewart of Long Beach, Cal. The motor is shown in section below. The primary object of the motor is to eliminate the poppet valve and to secure more even compression at all times by using piston valves instead. It is also hoped by the use of the piston valve to increase the efficiency of the motor without the addition of weight.

One of the purposes of the piston valves which are clearly shown in the illustration is that in making their working strokes they will pump air on the descending stroke and on the ascending stroke they will force the air into a storage tank attached to the motor. The general purpose of this air is to be used for air brakes, it being one of the inventor's ideas that it would not be necessary to use the foot or hand brake on long descents.

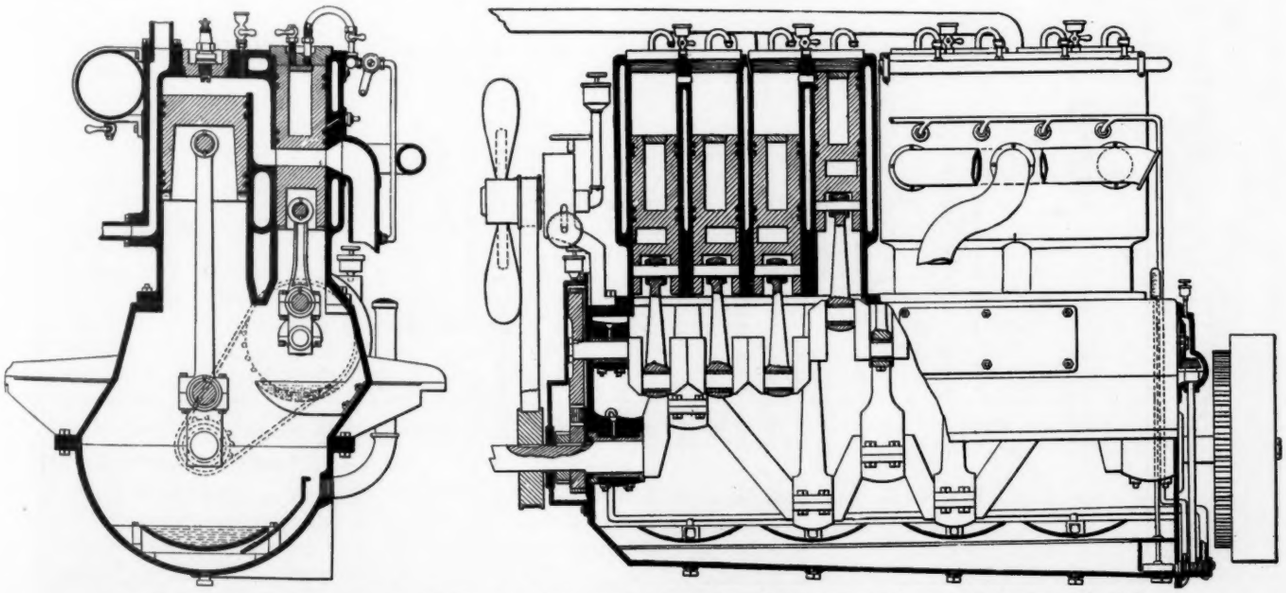
The air is also used for starting the motor, inflating tires, cleaning and dusting the car, raising an air jack, producing air for the carbureter and any other purposes for which compressed air in a clean, pure condition may be employed. The over-production of air passes through the exhaust to keep it clean.

In general, the motor is a four-cycle design which other than the valve mechanism does not vary materially from common practice, the oiling system is splash and force feed with rocking oil pockets. As may be noted from the illustration the piston valves are driven by a short throw crank and connecting-rod from an auxiliary shaft which could be driven by silent chain from the crankshaft. The inventor believes that by careful carrying out of the details of this design no material weight will be added while the advantages of the compressed air and piston valves will be obtained.

Design Has Possibilities

The novel idea in this motor is, of course, the suggestion that the piston valves should be used as air compressing pumps, and it is conceivable that on this account the engine might find some special sphere of usefulness. It would, like all piston valve motors, be rather expensive to make, and it would not be easy to get very large port openings.

For very large, heavy motors such as can be used for fire department vehicles or for boats would appear to be the most promising field of application at the moment, and the idea seems to have merit enough to warrant further investigation and experiment. It will be interesting to see if the motor succeeds in reaching the practical stage.



End and side sectional views through the piston valve motor invented by E. U. Stewart of Long Beach, Cal.

Piston Displacement of Twelve-Cylinder Engines in Cubic Inches

Stroke—Inches	Bore—Inches																													
	2½	2 3/16	2¼	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	3	3 1/16	3⅛	3 3/16	3¼	3 5/16	3⅜	3 7/16	3½	3 9/16	3⅝	3 11/16	3¾	3 13/16
2½	107.3	113.4	119.2	127.0	132.5	139.2	146.1	153.1	160.3	167.7	175.3	183.0																		
2¾	113.3	119.7	125.6	134.1	140.0	147.0	154.2	161.6	169.3	177.1	185.0	193.1																		
2⅞	119.3	126.0	132.1	141.2	147.2	154.7	162.3	170.2	178.2	186.4	194.8	203.3																		
3	125.2	132.3	138.5	148.2	154.6	162.4	170.4	178.7	187.1	195.7	204.5	213.5																		
3⅛	131.2	138.6	145.0	155.3	162.0	170.2	178.6	187.2	196.0	205.0	214.2	223.6																		
3¼	137.2	144.9	151.4	162.3	169.3	177.9	186.7	195.7	205.0	214.3	223.9	233.8																		
3⅜	143.1	151.2	157.9	169.4	176.7	185.6	194.8	204.2	213.8	223.7	233.7	243.9	254.4	275.2																
3½	149.1	157.5	164.3	176.5	184.1	193.4	202.9	212.7	222.7	233.0	243.4	254.1	275.0	276.2	287.6	299.2														
3⅝	155.1	163.8	170.7	183.5	191.4	201.1	211.0	221.2	231.6	242.3	253.2	264.3	275.6	287.2	299.2	311.2	323.6	336.0												
3¾	161.0	170.1	177.2	190.6	198.8	208.8	219.1	229.7	240.5	251.6	262.9	274.5	286.2	298.4	310.6	323.2	336.0	349.0	362.4	375.8										
3⅞	167.0	176.4	183.6	197.6	206.2	216.6	227.2	238.2	249.4	261.0	272.7	284.6	296.8	309.4	322.2	335.2	348.4	362.0	375.8	389.8	404.0	418.6								
4	173.0	182.7	190.1	204.7	213.5	224.3	235.3	246.7	258.3	270.3	282.4	294.8	307.4	320.4	333.6	347.2	360.8	374.8	389.2	403.8	418.6	433.6	449.0	464.6						
4⅛	178.9	189.0	196.5	211.7	220.8	222.0	243.4	255.2	267.3	279.6	292.1	304.9	318.0	331.4	345.2	359.0	373.4	387.8	402.6	417.6	433.0	448.6	464.4	480.6	497.0	513.8				
4¼	184.9	195.3	203.0	218.8	228.2	239.8	251.6	263.7	276.2	288.9	301.9	315.1	328.6	342.6	356.6	371.0	385.8	400.8	416.0	431.6	447.4	463.6	480.8	496.6	513.6	530.8	548.4	566.2		
4⅜	190.8	201.6	209.4	225.9	235.6	247.5	259.7	272.2	285.1	298.2	311.6	325.2	339.2	353.6	368.2	383.0	398.2	413.6	429.4	445.4	461.8	478.4	495.4	512.6	530.2	548.0	566.0	584.4		
4½	196.8	207.9	215.9	232.9	243.0	255.3	267.8	280.7	294.0	307.6	321.3	335.4	349.8	364.6	379.6	395.0	410.6	426.6	442.8	459.4	476.2	493.4	510.8	528.6	546.8	565.0	583.8	602.8		
4⅝	202.7	214.2	222.3	239.9	250.3	263.0	275.9	289.3	303.0	316.9	331.0	345.6	360.4	375.6	391.2	407.7	423.0	439.6	456.2	473.4	490.6	508.4	524.0	544.6	563.2	582.2	601.4	621.0		
4¾	208.7	220.5	228.7	247.0	257.7	270.7	284.0	297.8	311.8	326.2	340.8	355.8	371.0	386.8	402.6	419.0	435.6	452.4	469.6	487.2	505.2	523.4	541.8	560.6	579.8	599.4	619.2	639.2		
4⅞	214.7	226.8	235.2	254.1	265.0	278.5	292.1	306.3	320.7	335.6	350.5	365.9	381.6	397.8	414.2	431.0	448.0	465.4	483.0	501.2	519.6	538.2	557.4	576.6	596.4	616.4	636.8	657.6		
5	220.6	233.1	241.6	261.2	272.4	286.2	300.2	314.8	329.6	344.9	360.3	376.1	392.2	408.8	425.6	442.8	460.4	478.2	496.6	515.0	534.0	553.2	572.8	592.8	613.0	633.6	654.6	675.8		
5⅛	226.6	239.4	248.1	268.2	279.8	293.9	308.3	323.2	338.5	354.2	370.0	386.3	402.8	419.8	437.2	454.8	472.8	491.2	510.0	529.0	548.4	568.2	588.2	608.8	629.6	650.8	672.2	694.0		
5¼	232.6	245.7	254.5	275.3	287.1	301.7	316.5	331.8	347.4	363.5	379.8	396.4	413.4	431.0	448.6	466.8	485.4	504.2	523.4	543.0	562.8	583.2	603.8	624.8	646.2	667.8	690.0	712.4		
5⅜	238.5	252.0	260.9	282.3	294.5	309.4	324.6	340.3	356.3	372.8	389.5	406.6	424.2	442.0	460.2	478.8	497.8	517.0	536.8	556.8	577.2	598.0	619.2	640.8	662.6	685.0	707.6	730.6		
5½	244.5	258.3	267.4	289.4	301.8	317.1	332.7	348.8	365.2	382.2	399.2	416.8	434.8	453.0	471.8	490.8	510.2	530.0	550.2	570.8	591.8	631.0	634.8	656.8	679.2	702.0	725.2	748.8		
5⅝	245.5	264.6	273.8	296.4	309.2	324.9	340.8	357.3	374.2	391.5	408.9	426.9	445.4	464.0	483.2	502.8	522.6	543.0	563.6	584.6	606.2	628.0	650.2	672.8	695.8	719.2	743.0	767.2		
5¾		270.9	280.3	303.5	316.6	332.6	348.9	365.8	383.1	400.8	418.7	437.1	456.0	475.2	494.8	514.6	535.0	555.8	577.0	598.6	620.6	643.0	665.6	688.8	712.4	736.4	760.6	785.4		
5⅞		277.2	286.7	310.6	333.9	340.3	357.0	374.3	392.0	410.2	428.4	447.3	466.6	486.2	506.2	526.6	547.6	568.8	590.4	612.6	635.0	657.8	681.2	704.8	729.0	753.4	778.4	803.6		
6													477.2	497.2	517.8	538.6	560.0	581.8	603.8	626.4	649.4	672.8	696.6	720.8	745.6	770.6	796.0	822.0		
6⅛													487.2	508.2	529.2	550.6	572.4	594.6	617.2	640.4	663.8	687.8	712.2	736.8	762.0	787.6	813.8	840.2		
6¼													498.4	519.4	540.8	562.6	584.8	607.6	630.8	654.2	678.2	702.8	727.6	753.0	778.6	804.8	831.4	858.4		
6⅜													509.0	530.4	552.2	574.6	597.2	620.4	644.2	668.2	692.8	717.6	743.0	769.0	795.2	822.0	849.2	876.8		

The FORVM

HOTCHKISS DRIVE ADVOCATED FOR HEAVIEST CLASS OF TRUCKS —EFFECT OF CONDUCTIVITY OF PISTON IN COOLING DISCUSSED

Hotchkiss Drive for Trucks

By A. M. Laycock
Chief Engineer Sheldon Axle & Spring Co.

EDITOR THE AUTOMOBILE:—At the present time, when live axles are being used so extensively for heavy motor vehicles, there is no more debatable point than the question of driving through the springs as against the use of radius rods and torsion members. Driving through the springs has been very successfully used in the pleasure car field for a good many years, particularly in racing cars, but in this discussion I would much prefer to confine my remarks to its application to worm gear design as applied on very heavy motor truck construction.

On the 1000-lb., 1500-lb., 1-ton and 2-ton sizes, it is generally conceded that this form of drive cannot be improved upon, but there is quite a little misunderstanding in regard to its application to 3-ton and 5-ton chassis and upwards. In the writer's estimation on the 3-ton and 5-ton class the forces acting on the spring eye are very much less in proportion than on the lighter vehicles, the speed factor being the important item.

In England, in the early days of the automobile, it was thought impossible to operate successfully any worm gear axle without the parallel radius rods and cantilever spring suspension as brought out by Lanchester on his first model, Lanchester at that time claiming that to work worm gears successfully there must be some parallel motion given to the axle which would at all times maintain a uniform velocity on the pitch line and cut down the unit pressure per square inch which was at that time the all-important consideration.

Then, as now, the successful operation of the worm was entirely dependent upon the retention of the oil film, particularly under high pressure, and unless the radius rods gave to the axle a parallel motion, as in the Lanchester suspension, the load came on the bronze gear with rapidly varying force as compared with a uniform pressure when the parallel motion was employed. Up to the present time in the United States there has not been a single adoption of the Lanchester suspension in its entirety.

The particular and all-important point of which designers in general have lost sight is, that the center line of the worm shaft must at all times be parallel to the center line of the engine power plant, which of course gives an equal angle to the rear universal joint as obtained on the forward one, transforming the uniform velocity into a variable in the propeller shaft and then changing it back into a uniform velocity (owing to the equal angles) and maintaining that uniform pressure which is so desirable in worm gear operation. The stresses created in some of our heavier 5-ton vehicles, equipped with radius rods and torsion members must be very high as compared with the sweet, harmonic motion of similar trucks equipped with the Lanchester drive.

Hotchkiss Drive Gives Parallel Movement

The point must be conceded, however, that very successful results have been obtained as regards the life of the worm unit, differential and the various parts influenced, but the question still remains—how much longer life would these same parts have if no radius or torsion members were used?

The illustrations as shown in Figs. 1 and 2 are anything but conventional designs, but the worm has been purposely underslung in order to describe and exaggerate the angles and bring out the points more clearly. In Fig. 1 you will notice there is no angularity whatever on the rear joint, but the torsion member tilts the rear axle up, generally pointing the worm shaft to the forward universal joint center. If the torsion member is raised somewhat and the worm shaft is tilted up more, one can obtain fairly satisfactory results, particularly when the eye of the torsion member is in the center of the propeller shaft longitudinally, for this also gives equal angles on both universals and so an unvarying worm velocity, but this construction has been very rarely carried out in practice.

It might be well to notice the action of the flat spring under load as this approaches very close to the Lanchester suspension, but cuts out its attendant complication. The prevailing idea at the present time is quite erroneous in regard to the front eye being the pivotal point and that the axis of the worm shaft moves around that point. The rear half of the spring always corrects the movement and imparts a true parallel motion within certain limits of deflection.

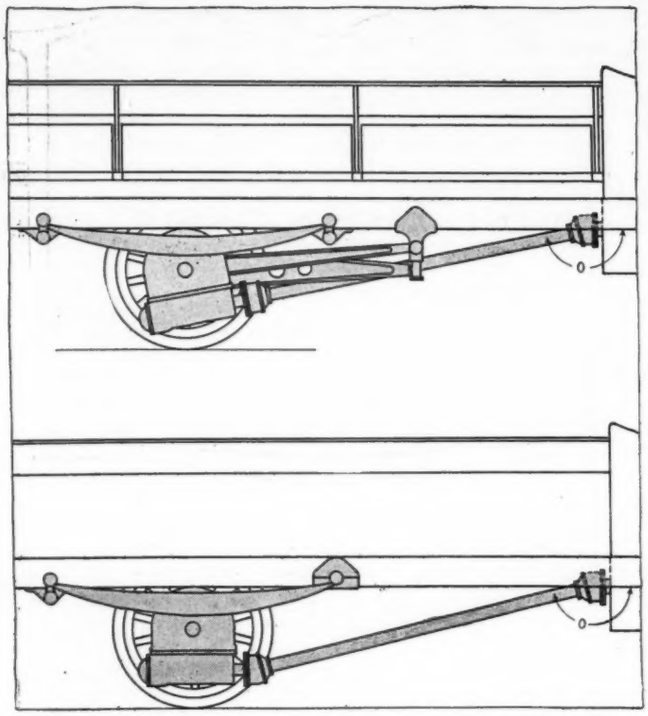
Springs Should Be Flat

In a good many designs abnormal cambers are used. This of course defeats the very object of driving through the springs, not only increasing the bending moment on the spring but upsetting the parallel motion to an alarming extent, particularly when the brakes are applied vigorously.

It is well also to note that in the Hotchkiss drive the spring seats attached to the axles are welded and not swiveled as in the radius rod and torsion member construction, which always gives more or less trouble particularly when operating in places exposed to mud and water, as it is most difficult to lubricate this bearing satisfactorily.

One of the greatest claims that Lanchester made for his parallel radius rod and cantilever suspension was the wear on tires. At that time, quite a few objections were raised in regard to the riding qualities of the Hotchkiss drive on account of the brake and torque reactions, but it is very interesting to note that this view is rapidly being changed. In the writer's opinion, the additional load put on from the brakes, and the torque reaction, assist very materially in dispensing with the use of the shock absorber, as the only time you need the shock absorber is when additional work is put on the spring, and this automatically increases the friction between the plates which naturally damps the effect of the spring.

Furthermore, by utilizing the Hotchkiss construction you have eliminated two spring seat bearings to take care of, two bearings on the torsion member, and four on the radius



Figs. 1 and 2—Diagram comparing torque arm with Hotchkiss layout

rod; and an additional two bearings on the springs, when the springs are suspended on links, together with the weight of all the parts named—a quite considerable item. Thus there seems everything in favor of driving through the springs on very heavy vehicles.

Analyzing Heat Flow

By E. H. Sherbondy

Consulting Engineer Clay & Sherbondy

EDITOR THE AUTOMOBILE:—Again reviewing the use of aluminum for automobile motor construction.

Mr. Leopold brought to light some interesting historical facts as to the use of aluminum for motor pistons and cylinders and to these I should like to add the following comments:

Interesting Historical Facts

In 1902 Alexander Winton of Cleveland built a racing car having a two-cylinder opposed crank motor in which he used aluminum cylinder heads and later in 1903 he used aluminum heads in the racing car "Bullet No. 2." During 1904 the German Daimler company built some large high-speed gasoline motors, after the designs of Loutski. These motors were six cylinders of 12-in. bore and 7½-in. stroke running at 900 r.p.m., developing about 1500 b.h.p. They were equipped with aluminum pistons and this is the earliest application within the writer's knowledge. These motors were designed for the use of submarines.

About 1905 Emile Mors brought out a design for a four-cylinder motor of 105 mm. and 150 mm., which comprised a number of novel features in design, among others, cast-iron sleeves pressed into aluminum jackets. The cylinders were T-head valve arrangement, cast in pairs, and the external appearance was very similar to that of the conventional iron cylinder design. I believe the St. Louis Car Co. produced a limited number of these motors under license. Prior to the general advocacy of aluminum pistons in America many French engineers had considered the subject.

In 1909 the Tony Huber Peugeot motors submitted to the A. C. F. were equipped with aluminum pistons.

A French engineer and writer, A. Contet, has given some comments on aluminum pistons, showing comparative power curves of the same motor using aluminum and iron pistons. These power curves indicated that there was a slight rise in mechanical efficiency as would be expected by reducing the inertia forces, however, his consideration of the subject at that time was superficial. I was told some time back that Chenard-Walcker and Doriot, Flandrian, Parant have been using aluminum pistons continuously since 1910 with good success in small motors (80-90 mm. bore).

Engineers Are Hasty

In the case of aluminum pistons which are now in vogue commercially I find the majority of engineers with whom I have talked on this subject have not carried out comparative tests in the same motor with iron and aluminum and plotted the resulting torque and horsepower curves, but have gone over to the aluminum piston in new designs on the strength of superficial considerations, aluminum being the fashion as is the case of many details of motor-car construction which are not settled on by reason of their engineering value but rather conforming with some powerful precedent which has been established primarily as a result of commercial consideration. Some of the older engineers in the industry, who have had the widest possible experience are not yet sold on the aluminum piston proposition for commercial product.

Peugeot, Talbot, Sunbeam, Mercedes and a great many other firms well known and established purely because of their engineering ability, have more than a passing knowledge of the materials of construction they employ. Peugeot was carrying on experiments with aluminum pistons in 1909. Chas. Faroux of *La Vie Automobile*, told the writer that the Peugeot practical results were within 2 per cent in all particulars of calculations on which the designs were based. Certainly these European firms have shown far more originality, initiative and independence of thought than has been exhibited on this side of the water—and the only logical deduction is that they are better students of engineering than we are over here. Certainly you will not find them buying American cars to cut to pieces and see how the trick is done. To make a long story short, we don't diagnose the disease before we take the cure but join the motley crew because it's the thing that is "being don."

It has been repeatedly asserted, by some of those interested in this field of work, that the increased conductivity of aluminum over iron was a factor of great importance in the dissipation of heat from motor cylinders and pistons and in my former communication, I perhaps did not bring forth my views on this point in as clear a manner as might be desirable. However, I believe the following may be stated axiomatically. "The dissipation of heat necessary and unavoidable in an internal combustion engine is controlled by the initial and final heat elements," *i.e.*, the temperature, coefficient of conduction, convexion and radiation of the gases of combustion at a higher level and the temperature coefficient of conduction, convexion and radiation of the cooling water or air, as the case may be, at a lower level. The coefficient of radiation in gases undergoing combustion is as yet an indeterminate factor having been a matter of experiment and consideration by Clerk, Callendar, Hopkinson and others. See the magazine *Engineering* (British). The coefficient and conduction of gases in general is very low, varying with the density of the gas employed (about 1/14,000 that of copper). The coefficient of convexion depends upon the internal agitation of the gases of combustion at one end and the rate of circulation of the cooling water at the other. It should be noted that liquids in general have a very small coefficient of conduction and that the transfer of heat through a liquid takes place almost altogether by convexion and is merely due to the agitation of the liquid molecules.

According to Dr. Watson of the Royal College of Science (London), who has done so much good work carrying out complete motor tests, the conductivity of aluminum is a little more than twice that of iron, namely, 0.344 cal./cm. sec. for aluminum and 0.167 cal./cm. sec. for iron. In the case of the aluminum cylinder where the wall proper is of this material, the heat passing from the gases of combustion by means of radiation and convexion to the cylinder wall is carried through by conduction at twice the rate of speed occurring in the iron cylinder. This heat must be carried away from the wall—to prevent an undue rise of temperature—by the cooling medium, and the rate at which this is done depends only the temperature of the cooling medium and its rate of circulation, so that we see in this case at least the conductivity of the metal employed has no effect upon the regulation of the working temperature in an internal combustion engine.

In the future development of automobile engines, aluminum cylinders may be an important factor in reducing the weight and it is very probable that satisfactory designs will be worked out, but the sole advantage will be weight reduction and not some startling thermo-dynamic change.

Due to its great affinity for oxygen when molten, aluminum, when cast, is usually porous, and if used in cylinders, there is likely to be a large percentage of bad castings because of water leaking through the jacket chamber to the bore. This may be overcome by designing the cylinders so that the inside of the jacket and the cylinder wall can be painted with litharge.

Favors Inserted Sleeve

Probably the best way of using aluminum to advantage in an automobile motor is to cast the cylinder jacket and crankcase integral, to insert cast-iron sleeves to form the cylinders proper in much the same fashion which is used in large gas engines so that the cooling water comes into actual contact with the sleeve. In general this construction would necessitate a loose head.

In reply to Mr. Leopold's comments on my earlier communication.

It is, of course clear to anyone informed on elementary physical processes, that the transfer of heat from one portion to another of a continuous metallic body takes place by the vis-viva or living force of the molecules of that substance, which cannot change their position relative to the aggregate in which they are found but only their amplitude of vibration. This phenomenon is called conduction.

In my former communication I pointed out that the heat of the piston was carried off "mainly by convexion to the lubricating oil film." It, of course, is apparent that the heat must flow from the piston head proper to the side walls and that sufficient material should be supplied in the design and construction of a piston to attain this end. Now, as pointed out in my earlier article, the only two exits of importance for the heat residing in the piston is by the way of the lubricating oil film, or the cylinder wall proper where the oil film breaks down—and the crankcase air. Some of the piston heat is given up to the gases of combustion but a technical analysis of the interchange of heat between the gases undergoing combustion and the cylinder walls, involves the use of mathematics and is too complicated to be presented in these brief comments.

The heat must be carried off to the crankcase air by convexion and radiation, and as the crankcase air is always heavily laden with oil in various states of disgregation from large liquid drops to vapor, we have an added agency of importance. The coefficient of radiation of cast aluminum is rather low, and the heat given up in this manner should be accounted negligible. There remains one method of carrying the heat from the piston—convexion—which depends on the rate of circulation of the cooling medium. The rate of air circulation on the inside of the piston is not rapid unless some special construction is used to obtain a flow of air into and out of the piston. To this end the writer applied for and obtained patents in connection with other motor improvements some years ago. The German Daimler Co.—I believe through Paul Daimler—also have issued patents on means for circulating air on the interior of pistons. This work was carried out in both instances with a view to enabling large engines to run at very high speed, without running up the inertia pressures to unreasonable values, which would have occurred with water-cooled pistons.

Factor of Crankcase Air

The importance of the nature of these considerations relative to other factors at play in internal combustion engines appears rather small. It would be somewhat difficult to determine just how much heat of the total amount received by the pistons passes to the crankcase air but it would be my guess that the percentage would be very much less than that passing by way of the cylinder oil to the cylinder walls. There is, of course, plenty of data available in the case of water-cooled pistons, such as are used in larger work than we are considering at present. In conclusion of these remarks on the importance of the coefficient of conduction of the material employed, I can only hold to the deductions which seem inevitable, in view of evidence presented by a consideration of the physical processes involved.

In relation to the consideration of inertia pressure, I think my position on this matter was clear enough.

In review: I hold that the inertia pressure occurring in the commercial product issuing from motor car factories today is not a matter for serious consideration and that cast iron is certainly as satisfactory and far cheaper than any other material which may be employed for pistons in touring car motors. As Mr. Lawrence Pomeroy (Vauxhall Motors) puts it "when a motor gets up to 3000 r.p.m. or so, the average customer gets so thoroughly frightened at the job that he is glad to take his foot from the accelerator," and this is the point worthy of consideration above all others. However, I shall make the high-speed engine a matter for consideration in another article.

In reference to Mr. Diamond's comments: Mr. Diamond's point, namely, "that the diffusion of heat through the aluminum pistons is more rapid than cast iron," goes of course, unquestioned, and in my former article I touched on only a few of the high spots of this subject, which came to my mind in the short period at my disposal, at that time. I must, however, refer to my answer to Mr. Leopold in answer to the points at issue and in conclusion admit that I have no axe to grind other than the advancement of automobile engineering.

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Twin-Six Balance

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By D. Fergusson
Mechanical Engineer, Pierce-Arrow Motor Car Co.

EDITOR THE AUTOMOBILE:—I am sorry I did not have an opportunity of seeing Mr. Vincent's letter before mine was published. It would have admitted of my altering my letter slightly and would have done away with much of Mr. Vincent's argument. Will you please insert in your next issue that I wish to add the following postscript to my letter published in your issue of Oct. 28, 1915?

"To the loads due to the inertia of the pistons and the reciprocating parts of their connecting-rods, must, of course, be added the centrifugal force due to the rotating parts of the connecting-rods. I assume that the same standards of engineering practice are used in both the six- and twelve-cylinder types."

The History of the American Automobile Industry

Second Installment of the Complete History of the Industry in America, the Opening Installment Appearing in Last Issue —Complete History To Be Published Later in Book Form

This Week the Conception and Early Development of the Steam Vehicle, the Pioneer in the Automobile Field

By David Beecroft

THE year 1769 is to the history of steam automobiles what the year 1492 is to America. In 1769 Nicholas Joseph Cugnot, a Frenchman, built the first steam locomotive, which was a three-wheel vehicle. The next year Cugnot built a more perfected type of vehicle by means of State funds appropriated for the purpose, and a model of this vehicle is still in Paris. True, it was a crude affair, scarcely possessing a single feature that could be compared with the vehicles of to-day, yet it incorporated many of the basic features of the present-day steam engine, even if they were in forms that can scarcely be recognized, and handled a boat of 2.5 tons at 3 miles per hour. Cugnot used a bowl-shaped boiler that hung out in front, ahead of the single-drive wheel, the boiler being over 4 ft. in diameter. A fire beneath it supplied the requisite heat; and the steam was alternately conducted to two cylinders by means of a four-way cock. The cylinders were placed vertically above the single drive wheel and power was conveyed to the wheel by means of two ratchet wheels in connection with a system of pawls and rods. Cugnot steered by the single driver and so was spared the difficulties of solving steering, differential gears and other later problems. The frame was a stout wood one, which rested at the rear on the back axle with its wheel on each end and in front it joined an iron frame carried in bronze bearings on the axle of the driving wheel. Such was the pioneer steam vehicle.

If the honor of building the first steam vehicle goes to Cugnot and France the honor of making a steam vehicle possible must go to James Watt and Scotland. James Watt was a prominent engineer, who had been watching the crude steam engines that were used for pumping water in mines, these cumbrous affairs dating back to 1698, when they were first made practical by Thomas Savery, a Briton, to whom belongs the honor of being the first man to harness the power of steam to any useful practical device, as previous to that time steam was centuries old, but it had only been used in toys and for a few minor tasks.

The Savery engine had been improved by Thomas Newcomen, a Scotchman, in 1705, whose engines were the recognized designs from that time until 1763, when Watt made his great improvement on them. Watt saw that the Newcomen engine, explained later, was exceedingly wasteful of fuel and impossible of general adaptation. To improve its economy he conceived the separate condenser for the steam, and by this one invention gave us the condensing steam engine as we have it to-day and made it possible for steam to be adapted to vehicles and a myriad of other uses. Thus Watt, by this master stroke of genius, gave practical birth to the steam engine just as in 1876 practical birth was given to the gasoline engine of to-day by introducing the compression of the explosive mixture, which made it a reality.

It was by virtue of Watt's patent granted in 1769 and which expired in 1800 that Cugnot was able to make his first steam locomotive. But Watt did immeasurably more, in a few years he had invented the centrifugal governor, which is continued until to-day. He established the law in steam that the cylinders must be kept as hot as the steam entering them; he conceived the employment of the expansive power of steam in the cylinder; previous to his day water had been used to make the pistons steam tight, but Watt invented the packing as we have it to-day.

Although on Watt's shoulders rests the mantle of Father of the Steam Engine, we must not imagine his engine similar to ours of to-day. At that time the crankshaft as we know it to-day was unknown, and it was not until 1780 that the crankshaft was first used in an engine by Pickard. Previously various rod-and-ratchet devices were used.

After Cugnot's steam vehicle was running, activity in developing steam road locomotives, as they were then called, was rife in France and England, but no radical improvements were made until 1802, when Richard Trevithick, in England, built the first practical steam vehicle in that it incorporated so many of the features that time has proved are necessary in the steam vehicle as we know it. Trevithick built a steam engine with a crankshaft, as we know it to-day, in gasoline vehicles as well as steam automobiles. This crankshaft carried a flywheel; and Trevithick went further by connecting the crankshaft by gearing with the driving

road wheels. This Trevithick automobile made many journeys at speeds of 10 miles per hour, an amazing performance for 113 years ago. It was sold after being in use for 3 years to a hop rolling mill, where it furnished the motive power for many years. Trevithick must receive the honor of being the first inventor to transmit power from the motor to the drive wheels through a chain of gears, as well as being the builder of the first practical steam automobile.

The third big forward step in developing steam automobiles came in 1821 when the first steam vehicle that afforded comfortable accommodation for passengers was built. Cugnot gave us, in 1769, the first steam vehicle; Trevithick in 1802 gave us the first practical steam automobile and the honor of the first steam vehicle designed with the object of giving some comfort to the passengers it carried goes to Julius Griffiths of England. The body resembled that of a stage coach and was hung on springs and the boiler and motor were mounted on a special frame in rear of the coach body. A chain of gears connected the two-cylinder vertical motor to the driving wheels on the rear axle. The driver sat separately over the front axle, which was used in steering. Griffiths used an engine that condensed the used steam in a set of thin tubes and returned the water to the boiler for repeated use.

In this History of the Automobile Industry in America it is imperative to trace the evolution of steam and the steam vehicle from its inception in those countries where it was developed. Turning next to America, before completing the stage of progress abroad, it must be remembered that carriages and workmen were not plentiful in this new country at the time of the War of Independence.

The first steam engine in America was set up in a copper mine near Belleville, N. J., in 1753, at which time steam-engine construction could not have been very familiar to American inventors because of the large territory and the imperfect means of communication. In spite of these things Oliver Evans (1755-1819), a celebrated American engineer and millwright, turned his attention to the propulsion of road vehicles about 1772. In 1786 he petitioned the legislature of Pennsylvania for the sole right to use his steam engine in that State and was thought insane, an unjust accusation too often extended to many of his successors. Maryland, however, although probably thinking the same, granted him a patent for 14 years, dating from 1787. Another American inventor, Nathan Read, took up the steam automobile problem in 1788, 1789, and in 1790 applied for a patent for his invention.

Just which of these two inventors actually did the first work seems not to be known. Read obtained a patent for a multi-tubular boiler in 1791 and must therefore be given much credit by those who followed after him because of the greatly increased heating surface obtained by this construction with consequent faster steam generation and very greatly reduced size and weight. Whether or not this invention had much bearing on later work is not known. It may be that it was too early to be appreciated and so remained in obscurity until nearly a century had passed. Read proposed to use two double-acting engines, one driving each wheel so that in turning, each engine would respond to the slower or faster movement of the wheel. He also proposed to exhaust the steam rearwardly and thus take advantage of the reaction to assist in propelling the carriage. It seems not to have been then understood that in order to secure any satisfactory advantage from the reaction of an escaping jet of steam or other fluid, the moving part must be traveling very nearly half as fast as the motion of the escaping fluid. The reaction from a jet of escaping steam is very slight in its effect on a slow moving vehicle. He also applied his device to boats.

An Amphibious Vehicle

To Evans is usually given the credit of priority at this period for not only did he apply for patents in Pennsylvania and Maryland, but during his life he constructed a number of steam engines and made many attempts to secure capital for his steam carriage projects. Finally in 1804, while fitting up a steam harbor dredge for the City of Philadelphia he decided to make it self-propelling, and says, "This was a fine opportunity to show the public that my engine could propel both land and water carriages, and I resolved to do it. When the work was finished I put wheels under it; and though it was equal in weight to 200 barrels of flour, (about 20 tons) and the wheels were fixed on wooden axle trees for this temporary purpose, and in a very rough manner, and attended with great friction, of course, yet with this small engine, I transported my great burthen to the Schuylkill with ease; and, when it was launched into the water I fixed a paddle-wheel at the stern and drove it down the Schuylkill to the Delaware and up the Delaware to the city, leaving all the vessels going up behind me at least half way, the wind being ahead."

From the above account it would seem that this was his only self-propelled experience. The load was exceptionally heavy. The distance, however, was but 1½ miles, the streets probably good and the speed unquestionably slow. It was, however, a very creditable showing both on land and on water and compares very favorably with the work of others at or near that time.

It must be kept in mind that there was very little vehicle traffic at that time. American stage coaches began running in 1786 and then only between the more important centers. The rivers were the principal means of communication outside of private conveyances. Practically everyone was compelled to depend upon his or her own conveyance, although as far back as 1697 John Clapp at the Bowery, New York, kept a hackney coach for the convenience of patrons. It is an interesting comment on the tendency of the people to hold back progress by restrictive laws that in 1699 a law was passed in New York against fast driving of "slees" (sleighs). Words would probably not express the horror of those ancient law makers could they have been transported into modern New York with its never ending streams of rapid automobiles.

Stating the Case for the Eight

Comparing Eights with Twelves Shows Many Advantages for Simpler Type—Comparative Figures for Balance and Efficiency

By Charles S. Crawford*
Chief Engineer Cole Motor Car Co.

THE required range of ability, *which in substance means the capacity of the engine to do the ordinary thing and to answer everyday requirements*, is that which can be utilized in practice, and a speed range that will give a car from 2 to 60 m.p.h. in high gear, is, as we all know, ample.

The desirable torque must be maintained throughout the useful speed range, and this the eight-cylinder engine does.

This range of capacity depends upon the ability to run the engine to reasonably high speed without detrimental vibration and to arrange the gear ratio in relation to the highest speed that can be developed with a maintenance of torque.

To illustrate this: If an engine running at 2600 r.p.m. can, with a given gear ratio, make a car go 60 m.p.h., then the necessary size or displacement of the engine can be determined by the torque necessary to reach this speed in a given time, or with a given acceleration, say, of from 10 to 50 m.p.h. in a certain number of seconds.

This will then utilize to advantage all the power the engine can develop at its highest useful speed, which is limited by the volumetric efficiency at the said speed, or the ability to maintain a proportional torque. To attain this result is simply a matter of design and the proper development of the power plant.

Fundamentally, the torque developed is dependent on the displacement and the mean effective pressure on the pistons. Given a full charge in the cylinders by volume, this pressure is proportional to the energy of the mixture.

To illustrate this point more clearly: There is a certain mixture of gasoline and air which, with normal quality of gasoline, is about one to fourteen. This is the most efficient from the point of perfect combustion, which means that the energy which we derive from it on its combustion is a maximum consistent with the heat energy in the fuel.

It is possible to increase the explosive pressure by an increase in the strength of the mixture, that is, an increase in the heat energy of the mixture, and this can only be accomplished by having the maximum weight of gasoline and air.

We might have the best of volumetric efficiency from a valve-timing viewpoint and yet the heat energy of the charge would not be a maximum if it were of too high a temperature or partially expanded before entering the cylinder.

Excess compression of the charge in the cylinders does not add to the pressure. We still have the same quantity of heat units in the mixture and by excessive compression we do not increase these. More work is done on the compression stroke, and though the initial pressure is higher there is no net gain in work on the crankshaft.

Thus it follows that the chief advantage of increasing the compression is to obtain rapidity of ignition at high speed and not to increase the torque at low speed. With an eight-cylinder engine, properly designed, we secure every advantage necessary for practical purposes, therefore, without incurring the danger of trouble by going beyond that point. *The torque developed in an eight should be and is greater than that of a twin-six with the same displacement, for there is a greater heat loss with an increased number of cylinders.*

The area of cylinder wall exposed is proportionately greater, the displacement being the same, and when it is considered that approximately 60 per cent of the heat energy of the fuel is lost through the cooling water and radiation, the fallacy of too great a number of cylinders with a consequent decrease in individual cylinder displacement becomes evident, while the presumption that, by reason of the small bore and increased compression it is possible to increase the available torque, also, is shown to be fallacious.

Engines with small bore and necessarily high compression, while being advantageous at the very high speeds, invariably give unsatisfactory operation at lower speeds, and it is always necessary to retard the spark in order to prevent knocking. It follows, necessarily, therefore, that the eight, with its larger bore and consequently lower compression, is bound to possess advantages in this respect and *must of necessity give a smoother operation at the lower speeds.*

Acceleration and Torque

As we have defined the desirable range, we can assume that with the engine running at 2565 r.p.m., in order to get a road speed of 60 m.p.h. with 35-in. wheels, eliminating slippage, a gear ratio of 4 5/11 to 1 is required. From this basis, establishing a definite acceleration, the necessary displacement of the engine to get the torque essential, can be determined.

In the light of the performance of powerful multiple-cylinder cars, the acceleration of from 10 to 50 m.p.h. should be accomplished in from 20 to 25 sec.

Cole eight stock jobs well run in, carrying three passengers and with windshield and top up, will give an acceleration of from 10 to 50 m.p.h. in from 22 to 24 sec. The motor has a piston displacement of 346 cu. in., giving a maximum torque of 187½ ft.-lb.

The horsepower and torque curve of this engine is shown in Fig. 1, while in Fig. 2 is shown the torque developed per cubic inch of piston displacement. Incidentally, the torque developed per cubic inch of piston displacement of a twin-six engine is also shown in Fig. 2.

In this figure *A* represents the curve of the eight-cylinder engine, while *B* designates that of the twin-six under similar conditions.

The torque in the eight is conventional, inasmuch as the most efficient speed is in the neighborhood of 1000 r.p.m., which corresponds to 750 ft. per minute piston speed. This is only what could be expected, for at this speed the gas velocity is at a maximum, consistent with the manifold friction, while the volumetric efficiency is a maximum, by reason of the relation of this velocity and the time element of the valve openings. The temperature at this speed is consistent with good thermal efficiency, and the relative curves show, also, where the cooling theory has its effect on the thermal efficiency.

At the lowest speeds it is virtually impossible to have a greater torque than at any other speed if a normal torque is developed at the usual speed of maximum torque, because the

*From a paper read Oct. 29 before Indiana Section S. A. E.

gaseous inertia, on which we rely to a great extent to fill the cylinders, has not reached a point where it can overcome the skin friction of the manifold, the port and the valve openings, and still maintain a reasonable velocity.

These statements and those which immediately follow will correct the assumption left with us on a previous occasion that, by reason of multiple cylinders, it is possible to get the maximum torque at the lowest speeds of revolution.

Since the torque is proportional to the horsepower and speed, and therefore can be deduced from a factor which is constant, it is difficult to see how it would be possible to obtain from horsepower curves which are similar in characteristics torque curves which are so widely different at the lower speeds. Yet this is precisely what is inferred from the characteristic curves of single-six and twin-six engines of approximately equal capacity, brought previously to our attention.

The torque frequency has no influence on the magnitude of the torque developed at lower speeds. However, the ability to attain increased volumetric efficiency and better distribution of the charge is responsible for the actual increase that does occur.

Where the eight scores in generating increased torque at lower speeds is in its undoubted ability to distribute the mixture to better advantage. In support of this contention a layout of the manifolds to scale is shown in Fig. 3, which presents clearly the equidistant port locations and the comparatively short distance of each from the carbureter.

The importance of limiting the manifold lengths to obtain good volumetric efficiency and likewise torque at the lower speeds being obvious, the ability of the eight's construction to give this condition stands out prominently, and is thus seen to be more pronounced than in any other type of multiple-cylinder engine.

The efficiency of the carbureter, by reason of constant jet suction, is logical in the eight, while the suction strokes if closer together, as in the twin-six, produce an excessive lap which creates at some point almost double suction in the manifold.

In regard to frequency of impulse it is asserted that the frequency is proportional to the number of cylinders. The actual frequency at the road wheels is the *determining* factor, however, and this is dependent on the gear ratio.

Unbalance and Vibration

Smoothness *from the point of engine balance* is the next point that requires study. In the conventional fours there are, from their inherent design and construction, unbalanced forces due to inertia, which increase with the square of the speed. This unbalanced force is fundamental in the four but not necessarily in the eight, as is commonly supposed.

While the forces do occur as calculations show, there must be a fair amount of discrimination in discussing the relative balance of mechanisms that have respectively unbalance and perfect balance, viewed theoretically.

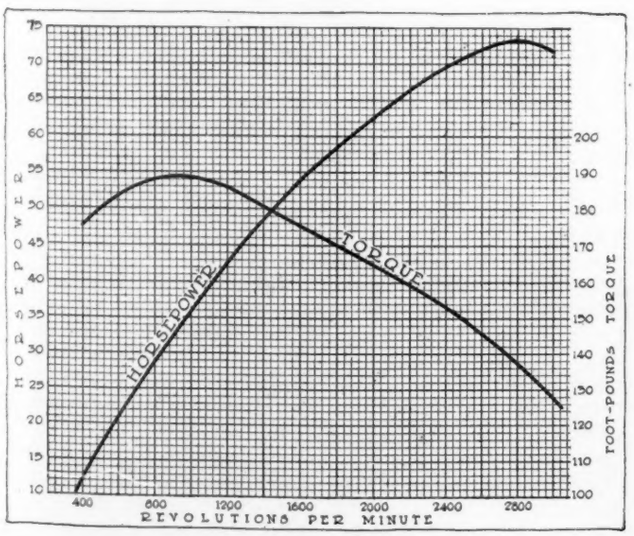


Fig. 1—Power and torque curves of Cole eight

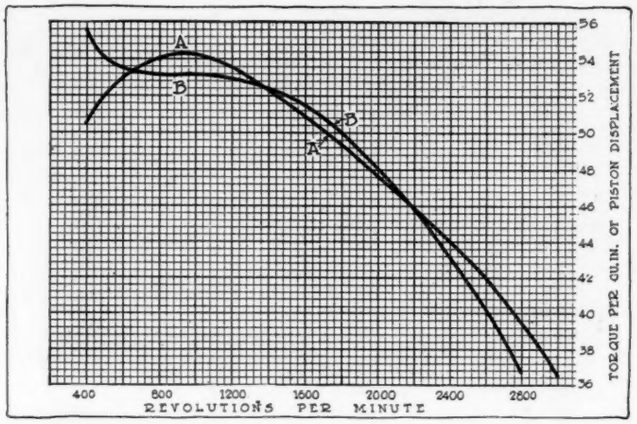
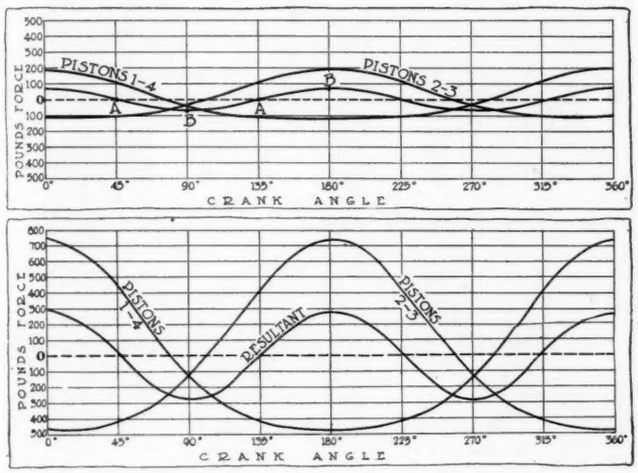


Fig. 2—Torque per cubic inch piston displacement for Cole eight and also a twelve-cylinder engine. A is the curve for the eight and B that of the twelve



Figs. 4 and 5—Unbalanced force fluctuations in an eight-cylinder engine. Upper—at 1000 r.p.m. Lower—at 2000 r.p.m.

There are two fundamentally distinct problems in connection with vibration and balance. There are the vibrations that arise from unbalanced systems, considering all the parts as rigid within themselves, and vibrations or sources of vibration due to the elastic yielding or springing of the parts of the system—such as the crankshaft, which is subject to bending and torsion; the connecting-rod, which acts as a strut and obeys the law as such in connection with rigidity, and sustaining members, such as the engine crankcase.

The vibrations arising from lack of rigidity in the crankcase can be attributed to the influence of the forces on either side of the plane of symmetry.

Supposing the engine were articulated at the middle, or plane of symmetry. We can see that each half would rock against the other in a symmetrical manner, influenced by the couples exerted by the centrifugal and inertia forces on the crankshaft.

The stress of the crankcase section at its middle point, therefore, resists this tendency, the magnitude of which increases with the length of the crankshaft and crankcase,

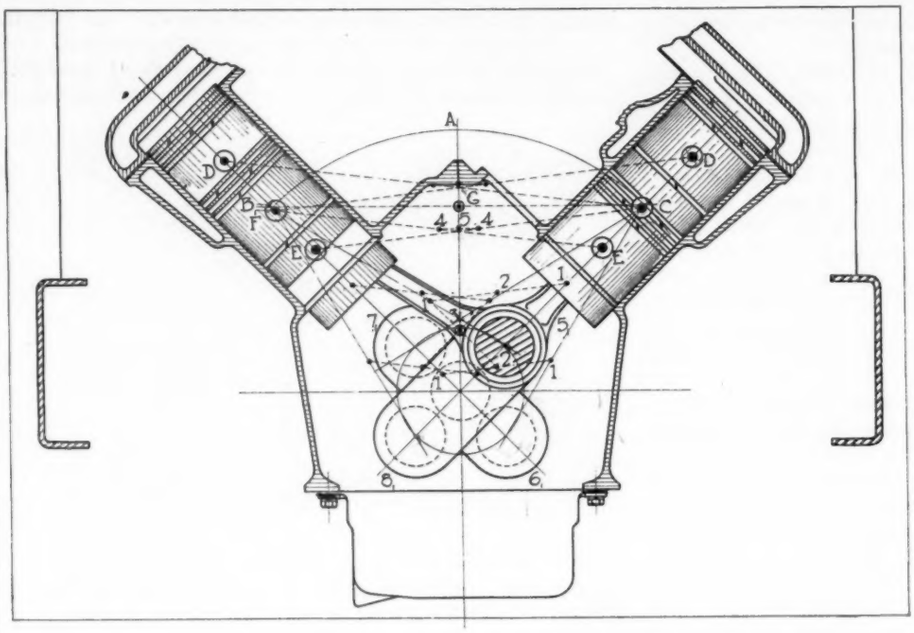


Fig. 8—Relative piston positions and mass center movement in eight with 90 degree crankshaft

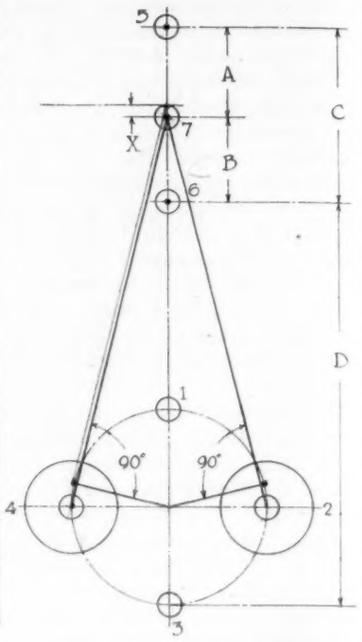


Fig. 6—Diagram of piston mass center movement in single cylinder

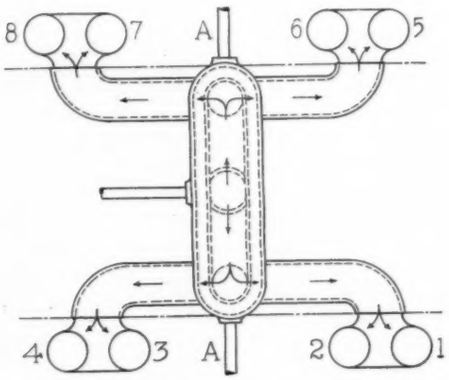


Fig. 3—Intake manifold layout of eight

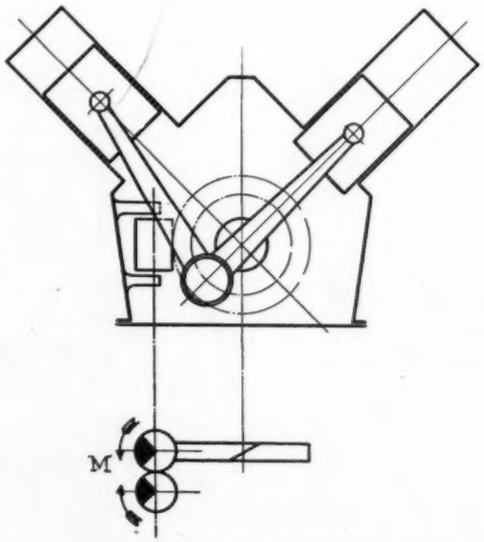


Fig. 12—Lanchester anti-vibrator for neutralizing horizontal unbalanced force

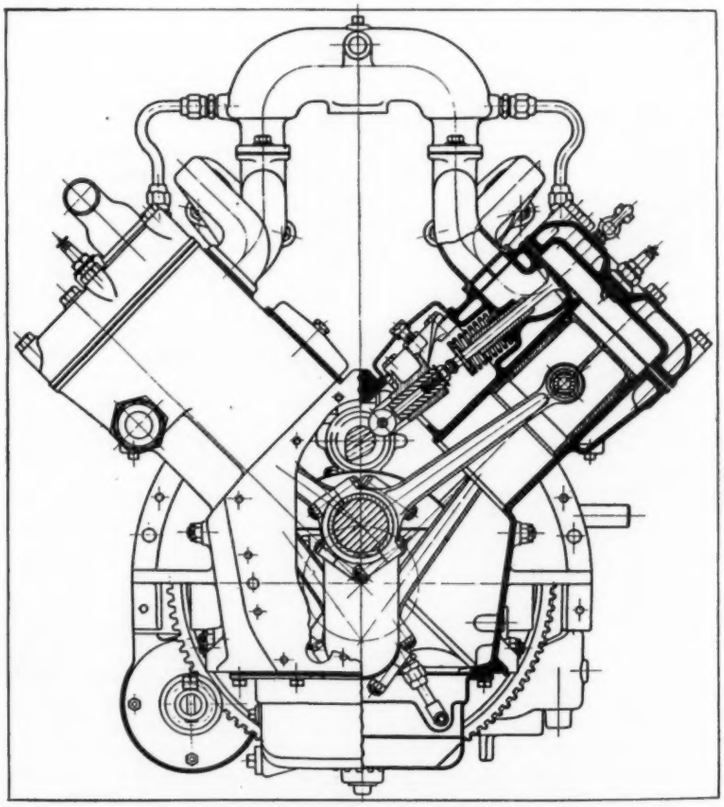


Fig. 16—Section of Cole eight

and an absence of rigidity, therefore, would result in a vibratory bending of the engine itself. The shortness of the crankshaft and crankcase and consequent rigidity of the eight, therefore, is distinctly favorable.

Likewise, the counterbalancing of the crankshaft eliminates to a marked degree the couple due to centrifugal forces and therefore the vibratory tendency is practically expelled. So far as the inertia unbalance of the eight is concerned, it is advisable to consider this, to some extent, to show that this is not objectionable. At the outset it would be wise to remark that while the horizontal vibratory force does exist, one is usually surprised at not being able to notice it when riding in an eight-cylinder car.

In order to show the actual magnitude of this vibration tendency at different speeds, curves labeled Fig. 4 and Fig. 5 are shown. Fig. 4 represents the magnitude of the unbalanced forces of the pistons in each block at 1000 r.p.m., and, as will be noticed, they are very small. Since this is the normal running speed, it explains the reason why vibration in the eight is not perceptible.

That this is true is more evident when you consider the effect of a force of this order acting upon the mass of the engine and the chassis. Imagine, for instance, applying a force of 70 lb. on a mass weighing 3500 lb., suspended on springs, by starting with zero and gradually increasing the force to the maximum in a time space corresponding to the periodicity of the revolutions. You could not feel it and this is exactly the condition that exists in the curve shown. At point *A* there is no force, but it is applied almost uniformly up to the maximum of 70 lb. at point *B*.

At 2000 r.p.m., which is a high rate of speed, and one not used for long periods, the forces increase as shown in Fig. 5. The forces plotted are the actual magnitudes as calculated for a 3½-bore motor with aluminum pistons.

It has previously been shown why this unbalanced condition exists, but in order to give a better idea and to elucidate more logically the points to which reference is made later in the paper, I have added diagram, Fig. 6. The four positions of the crankshaft are shown respectively, at 1, 2, 3 and 4, while 5 and 6 are the top and bottom of the piston stroke, respectively, point 7 being at the position of mid-piston travel. If the connecting-rods were of infinite length all four pistons would reach mid-stroke position at the same instant and at all other points, pistons 1 and 2 would have the same motion as pistons 3 and 4. With the connecting-rod of finite length, however, the positions of mid-stroke and mid-crankpin travel do not coincide, the error being as shown at *X*.

Now the inertia of the piston masses, or the energy stored in them, tending to keep the pistons in their state of motion, is dependent on the velocity or acceleration and the mass. As will be observed from the diagram, owing to the angularity of the connecting-rod and the position of the pistons at mid-crankpin travel, piston No. 4, traveling upward, will have farther to go than half-stroke by the amount *X* or a total *A*, while the piston going down will have less than half-stroke by the amount *X* or the distance *B*, to travel in the same time, which is in 90 deg. of crankpin travel. Therefore, the speed on the up-stroke of the piston will be greater than on the down-stroke, which explains the difference in the inertia of the piston up and down respectively. This is the magnitude of the inertia unbalance and has the effect of an external force equal to the difference of inertia of the pistons up and down.

The longer the connecting-rod the less will be the variation *X*, but the amount that this variation can be reduced is very slight unless the connecting-rod is impracticably long. The limit of length is determined by the rigidity sought. The longer we make the connecting-rod, the more substantial it must be to give the same rigidity as a connecting-rod of shorter length, and then weight becomes a factor to be considered.

So far as the influence of inertia on bearing wear is concerned, this will be the same whether it is a four, six, eight or twin-six engine, if the masses are equal, as the influence of inertia, or the accelerating force of the pistons on the crankpin, is independent of the balance of the masses as a whole.

The main bearing loads set up by the centrifugal effect of the crankpins and connecting-rod bearings are quite appreciable. In order to reduce these to an absolute minimum a counter-balanced crankshaft is used in all of our engines.

The counter-balances as shown in Plate 13 are effective because they counteract the effect of the centrifugal forces, and incidentally the balancing of the revolving masses as nearly as possible in the planes of rotation also has a remarkable steadying effect on the shaft as a whole, and eliminates to a marked degree local distortion of the shaft, thus preventing the periodic tremors that often exist as a result of this local deformation.

As a means of comparison of the bearing pressures due to the influence of inertia and explosion forces, refer to Table 7. It will be seen that actually in the eight-cylinder engine we have relatively less pressure on the connecting-rod and main bearing.

The relative balance of the six and eight has been illustrated in a previous paper before this section, and though it was asserted that the eight-cylinder engine is not a balanced system, I should not say that this statement was fundamentally in accord with the most recent scientific conclusions along this line.

In the course of our experiments made as a means of determining the influence of the theoretical unbalance of the conventional eight, we have experimented with various types of crankshafts designed to eliminate it and make a "system of bodies," or a theoretically balanced system, the same as we find in the six and twin-six.

Fig. 8 shows an end view of one of the shafts in question, the crankpins being at 90 deg. to each other. This demonstrates graphically the balance of the piston masses and the reciprocating portion of the connecting-rods. The angular location of the pins with respect to each other in the longitudinal plane and the effects thereof are shown later.

This illustration is made primarily to prove that an eight-cylinder V-type engine is not necessarily an unbalanced system. In the drawing it will be seen that the shaft is in dead center position. It will be observed that one piston is up and one down respectively, while two are in the position of mid-crankpin travel.

The same is true of each block and therefore the center of gravity will coincide in each block at any instant, the arc *A* struck from the center shaft passing through the center of gravity *B* and *C* as shown. The center of gravity of the pistons is indicated by the black spots in the line of piston travel. The positions *B* and *C* are midway between the center of gravity or mid-position of the pistons *D* and *E* and the center of gravity *F* of the other piston. Likewise, the center of gravity of the connecting-rods is indicated by the small dots on the center line of the connecting-rods as shown at 1-1.

The points 2-2 show the common center of gravity of the rods on the same crankpin, of which point 3 is the combined center of gravity of the whole and is common to all the connecting-rods and on the vertical center line of the motor.

The points 4-4 are the common centers of gravity of the piston masses on each crankpin, being midway between the center of gravity on each piston, the common center of gravity of each system being indicated at point 5, while *G* is the combined center of gravity of the whole system and coincides with the center of gravity of the pistons in both blocks as arrived at by the combination of the centers of gravity *B* and *C*. This, therefore, is an analogous condition to that of the six-cylinder engine.

As a further illustration and as a comparison with a conventional shaft, the existing inertia and accelerating forces are again plotted as shown in curves in Fig. 9 and Fig. 10. The inertia curves being superimposed at crank periods of 90 deg., the resultant is zero, as indicated at 0-0. This is arrived at by subtracting all the negative ordinates, or those beneath the zero line, from the positive ordinates above the zero line.

Figuratively we can arrive at the same conclusion by resolving the forces of inertia and acceleration of each piston into horizontal and vertical components. It will be seen in Fig. 8 that the piston masses 6(1) and 7(1) each have their resultant downward as the piston 6(1), having passed the position of maximum velocity, the energy of the piston will be doing work on the crankshaft while the piston 7(1), not yet having reached the point of maximum velocity, is still being accelerated by the crankshaft, its reaction being, therefore, downward. Adding up the forces we get zero as a resultant, showing that there is positively no resultant unbalanced force.

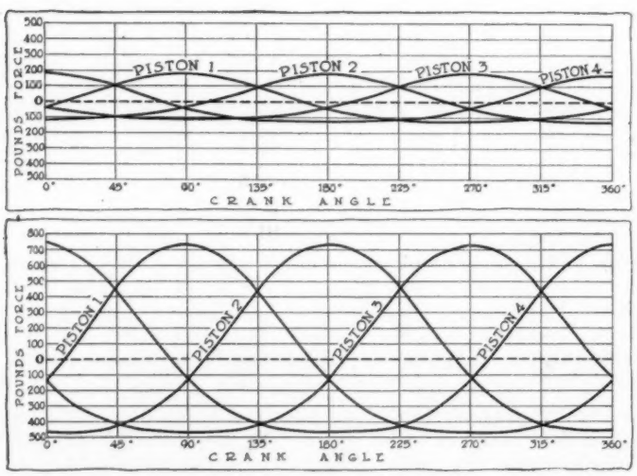
Special Crankshafts

The arrangement of the crankpins is shown in Fig. 14 and Fig. 15 and each exhibits different characteristics. There is not what we could term "looking-glass symmetry" in the same sense that it is found in the conventional shaft with the crankpins at 180 deg. in the same plane. In other words, while the shafts are identical in each half, about an axis in the center, so far as their structure is concerned, one-half, if placed before a mirror, would not show a true reflection of the other half. There will be, therefore, a rocking moment about a plane of symmetry at right angles to the crank axis.

In the first shaft in Fig. 14 a longitudinal couple of large magnitude does exist, due to the centrifugal effect of the crankpins and also the accelerating forces on the pistons. This would tend to rock the shaft about the center 0-0 as shown, and the magnitude is such that it can not be balanced practicably.

In the shaft in Fig. 15, however, while there exists a small rocking moment due to the accelerating forces of the piston masses, and also a rocking moment in a plane at right angles due to the centrifugal effect of the crankpins, the magnitudes of these rocking moments are very small in comparison with those in the first shaft, as can be seen from the sketch. In Fig. 15 the effects of the forces on adjacent crankpins tend to rock the shaft in opposite directions, the resultant being the difference of these moments. In the first case, on the other hand, they augment each other.

Therefore, it is entirely practicable and feasible completely



Figs. 9 and 10—Unbalanced force curves for eight with crankpins at 90 degrees as in motor.

Fig. 8—Upper—at 1000 r.p.m. Lower—at 2000 r.p.m.

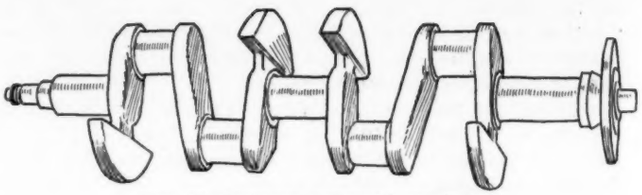
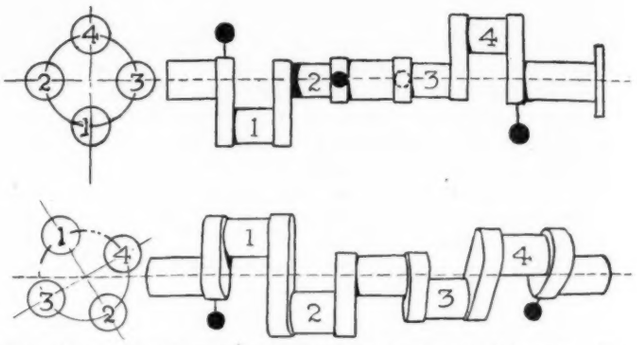


Fig. 13—Ordinary balanced crankshaft



Figs. 14 and 15—Balanced crankshaft with pins at 90 degrees. The lower of the two is the better design

to balance the centrifugal moment by the addition of balance weights on the end crank arms, and also to eliminate the inertia moment to such an extent that its presence would not be observed under any ordinary conditions.

The firing order for the latter shaft would be 1-5, 2-6, 8-3, 7-4 or 1-3, 7-4, 8-5, 2-6 and with crankpins 3 and 4 rotated 180 deg., the firing orders would be 1-5, 2-3, 7-4, 8-6 or 1-4, 8-3, 7-5, 2-6, which, with proper manifold design, are equally as good as the firing order of 1-8, 3-6, 4-5, 2-7, as used in the conventional shaft with the crankpins at 180 deg. The foregoing is sufficient to show the general characteristics of these experimental shafts as we have found them. And our experiments demonstrated that the equality of cylinder performance was of prime importance since we found that, with the unbalanced inertia forces eliminated, we could actually produce vibrations by erratic firing order when different camshafts are used and by purposely creating a condition of unequal cylinder performance.

The general conclusions drawn from these tests are that the theoretically unbalanced forces do not offer such objectionable vibrations as those which may be produced from other sources. This led us to assume that the vibration of the kind arising from the elastic yielding of the parts of the engine are far more serious.

If the vibrations due to the theoretical unbalance of the eight with the conventional crankshaft were perceivable or objectionable to the same extent as the critical vibrations of the six and twin-six, corresponding means could be employed to correct them.

Fig. 12 shows the "Lanchester anti-vibrator," as it can be applied to the eight-cylinder engine, which in effect supplies a countervailing movement of a mass of the same periodicity and opposite in direction to the unbalanced force in the engine. The masses M, revolving in opposite directions, neutralize each other in all but the horizontal plane where the combined centrifugal forces equal the vibratory force in the horizontal plane.

It will be observed that with a greater number of cylinders it would be harder to obtain equality of cylinder performance. Particularly is this true where the individual cylinder displacement is very small, because the little variations which occur either from the differences in valve timing or tappet clearances and manifold designs will have a greater effect than with the same variations on a larger cylinder displacement.

In respect to rigidity the eight is most certainly superior to any other combination. The crankshaft is exceptionally stiff and although the explosive forces in the cylinder of 3½-in. bore exceed those in a 3-in. bore, the great reduction in length and lesser distance between the supports give greater rigidity and consequently less deflection than does a longer shaft even though the pressure imposed upon it be somewhat smaller.

In the eight-cylinder Cole-Northway V-type engine the shaft is 2⅛ in. in diameter and the length between center of supports 10⅜ in.

Periodic vibrations at critical speeds in a six-cylinder engine have been attributed to the synchronism of the torsional oscillations of the crankshaft, due to the impulses and the natural vibration period of the shaft itself.

This was treated in a previous paper before this section, but while it was pointed out that the decreased length of the shaft of the twin-six would be a factor tending to reduce this periodic vibration, it is logical that the critical period in the twin-six will be just as pronounced. By shortening the shaft the periodicity or natural period of the shaft will be higher. But the explosive impulses are also closer together. In other words, the torsional frequency is higher, and since both the natural period and the explosive impulses are higher, the time when the periods will coincide and give a critical vibration will be the same irrespective of the fact that with a light piston and small explosive pressure there will be a decreased twist on the shaft.

If the natural period were of a higher frequency and the torsional period due to impulse had remained as in the six, it is possible that the time of synchronism would not have been within the speed range of the engine. This is precisely the condition that an effort was made to attain in the six by using a big, heavy shaft. Therefore, the same difficulties and disadvantages can be argued against the twin-six as are characteristic of the six, since many of these peculiarities recur in the twin-six. *They are not characteristic, however, of the eight-cylinder engine.*

Minimum Noise

By the term "minimum noise" we mean the ability of the mechanism to *operate* without objectionable sound. Previously we have dealt with the vibration and the noise resulting therefrom, and under this heading we will consider the noise resulting from the parts of the mechanism which come together with metallic contact due to the clearances that must naturally exist.

Since in any engine the clearances are practically the same, the noise therefrom will be substantially the same per contact. *Thus, the multiplication of the parts in operation will increase the noise in the same proportion as such multiplication occurs.*

Let us for a moment consider push-rod clearance. It is necessary in any type of engine to have definite clearances to provide for expansion of the valves. While the weight of the push rods may vary slightly in the case of large and small bore engines, the impact caused by the acceleration of the push rods will be substantially the same and will depend upon the angle through which the camshaft moves in taking up the clearance—in other words, the back-lash angle.

If the minimum specified clearance is not maintained, the noise produced is increased to a marked degree. Under these conditions the total sound made by the conglomeration of the small noises is accentuated in proportion to the multiplicity of parts. These conclusions bring forcibly into prominence the relative merits of the eight and twin-six power plants interpreted in terms of their relative simplicity and proportionate quietness.

Because of the shortness of the cylinder block and the detachable head, which acts as a baffle, and the fact that the connecting passages are proportioned so as to give correct circulation, even temperature throughout the cylinder block is assured.

To the accessibility of the valve mechanism great importance is attached. Given a clear valve alley, as in the case of the eight-cylinder V-type engine in question, it is seen in Fig. 16 that the greater amount of free space with a 90-deg. construction enables more easy manipulation of tools than with the 60-deg. construction of the twin-six. Incidentally, the ease with which the push rods can be moved will be noticed in the cross-section.

In a recent criticism of the eight it was assumed that the accessories must, of necessity, be placed in a so-called conventional position and because the particular construction of the eight did not permit with advantage the placing of the accessories in that position, it was considered distinctly disadvantageous.

It will be observed on the Cole eight, though the position of the accessories is not what is purported to be the conventional one, *distinct advantages are to be gained from the positions in which these accessories are placed.* The position of the water-pump is ideal, for it simplifies to a considerable degree the water-piping in distributing the water to each block.

(*Discussion Appears on pages* 861 *and* 862)

TABLE 7.

BEARING PRESSURES DUE TO INERTIA AND EXPLOSIVE FORCES

Cylinders, 3½ bore = 9.62 sq. in.
Maximum explosion pressure = 2700 lb.
Inertia forces of piston at 1000 r.p.m. = 186 lb.
Inertia forces of piston at 2000 r.p.m. = 747 lb.
Area connecting-rod bearing = 4.54 sq. in.
Unit explosive pressure on bearing = 587 lb. per sq. in.
Unit inertia pressure at 1000 r.p.m. = 41 lb. per sq. in.
Unit inertia pressure at 2000 r.p.m. = 165 lb. per sq. in.

TWIN-SIX

Unit explosive force = 871 lb. per sq. in.
Unit inertia pressure at 2000 r.p.m. = 379 lb. per sq. in.

TABLE 11

3½-IN. BORE, 4½-IN. STROKE, CONNECTING ROD 2⅛ S.

Weights:

Piston	15½	ounces
Rings	4	ounces
Pin and bearing	9½	ounces
Reciprocating part of connecting-rod	9	ounces
Total	38	ounces = 2.375 lb.

Angle X	Crank Angle factor	I. at 1000 r.p.m.	I. at 2000 r.p.m.
0	1.235	186.2	747
10	1.206	182	729
20	1.12	169	677
30	.984	149.5	595
40	.807	122.8	512
50	.602	91.5	376
60	.382	48.1	193
70	.162	24.6	98.5
80	—.047	— 7.15	— 28.7
90	—.235	— 35.7	—143
100	—.395	— 60	—240
110	—.522	— 79.4	—318
120	—.618	— 94	—378
130	—.684	—104	—416
140	—.725	—110	—440
150	—.748	—113.7	—455
160	—.760	—115.5	—462
170	—.764	—116.2	—466
180	—.765	—116.3	—467

The Rostrum

The Correct Way to Grind Valves

EDITOR THE AUTOMOBILE:—Often we get into an argument about the correct way to grind valves. Some say turn them all the way around and keep on that way, occasionally putting on some more grinding compound, and others state that you must not turn the valves over one-quarter way around, thus rotating back and forth. Others claim about half way around and thus rotate them backward and forward.

Now, what is the correct way to grind valves?

Plentywood, Mont. J. S. K.

—When grinding valves the valve should not be turned to a complete rotation at any time, but should be worked backward and forward to one-quarter the circumference. After this has been done several times, the valve should be lifted free of the seat and turned a distance of about one-third revolution and then the same reciprocating action carried on.

Insufficient Gasoline Causes Back-firing

Editor THE AUTOMOBILE:—What are the indications when there is not enough gasoline in the charge?

2—In an automobile spark coil what name is given to the coil through which the battery current passes and the coil in which a flow of current is induced?

3—How are the cranks of a four-throw crankshaft for a four-cycle engine arranged and how many bearings may such a crankshaft have?

4—What are the names of the two systems of water cooling?

5—What is meant by three-point suspension, and of what advantage is it?

6—What is meant by an open circuit, a closed circuit, a divided circuit, and a grounded circuit?

7—What effects are produced by a weak battery or a broken or leaky spark plug, a wabbling timer or a loose electrical connection?

8—What is a master vibrator and of what good is it?

9—Why must one or more universal joints be fitted to the propeller shaft?

10—Can quick detachable and clincher tires be used interchangeably on the same rims, and can tire lugs for one size and make of tire be used with other sizes and makes?

11—What is the difference between a timer and a distributer?

12—How does the selective type of transmission differ from the progressive type?

13—What is a float feed spray carbureter, and what is a compensating carbureter?

14—How does the current generated by a dynamo differ from that produced by a magneto?

15—What system of ignition requires the use of an igniter?

16—How are the cranks arranged for a four-cylinder two-cycle engine and how many power impulses are received by the crankshaft in a revolution?

17—How does the low-tension type of magneto differ from the high-tension type and which is the better type to use?

18—Can you explain how the power developed by the engine and the speed at which the car runs are affected by the driver's manipulation of the spark and throttle levers?

Fort Warren, Mass. W. N. T.

—The main indication that there is not enough gasoline in the charge is back-firing on quick throttle opening and lack of power on hills.

2—They are called the primary coil and the secondary coil, respectively.

3—Doubtless you are referring to ordinary four-cylinder practice which is to have the cranks at 180 deg. With this arrangement there may be either two, three or five bearings for a four-cylinder motor.

4—Thermo-syphon and pump systems. The thermo-syphon is that in which the water is circulated due to the temperature setting up a flow through the manifolds and radiator. The pump system is that in which the water is positively circulated by pump.

5—Three-point suspension means the suspension of the power plant at three points making a triangular layout. The advantage is that racking of the frame or twisting of the side members has a minimum tendency to impose strains on the motor supports.

6—An open circuit in electricity is a circuit which is not complete and through which current would flow as soon as the gap or opening in the circuit was closed. A closed circuit is one which is complete and through which current is flowing. A divided circuit is one in which the current from the main leads is divided to sub-leads. A grounded circuit is one in which the return current is carried through the construction of the car instead of by wire. It is common practice to ground on the main frame or side member.

7—Irregular and misfiring of the charge.

8—A master vibrator is one which performs the vibrating work for a number of coils. It is used to assure a uniform spark in each cylinder since the same adjustment of the vibrator points is bound to occur for each plug.

9—In order to compensate for the different slopes of the propeller shaft due to spring action.

10—There are universal rims which allow the different types of tire to be used.

11—The timer times the spark by breaking the circuit at the right moment whereas a distributer leads the current to the proper spark plug.

12—The selective type of gearset permits the driver to go into any speed from any other speed without passing through intermediate gears. In the progressive gear it is necessary to go in the order of one, two, three, four or four, three, two, one.

13—A float feed spray carbureter is one in which the gasoline level is controlled by a float and float chamber. All carbureters are designed to be compensating, or in other words, to take care of variations in loads and speeds.

14—The current generated by a dynamo of the type used in automobile practice is direct whereas with a magneto it is alternating.

15—You probably refer to the low-tension make-and-break system in which the make-and-break apparatus was known as an igniter.

16—In a four-cylinder two-cycle motor the crankshaft re-

ceives four impulses per revolution. Since there are 360 deg. to a revolution the explosions will have to be 90 deg. apart and the crank throws arranged accordingly.

17—The high-tension magneto differs from the low tension in that it carries its transformer coil in a unit whereas the low tension has the transformer coil separate. Where magnetos are employed for automobile ignition either the high-tension or low-tension will give perfect satisfaction although the high tension is more compact.

18—The power developed by the engine must necessarily depend on the amount of explosive charge in the cylinder, hence if you open the throttle more there will be more gas in the cylinder and therefore more power. Advancing the spark permits the explosion to take place early in the stroke and by allowing the motor to take advantage of the expansion of the burning gases gives a higher mean effective pressure.

N. Y. License Good in Eastern States

Editor THE AUTOMOBILE:—Will you please let me know the automobile registration requirements for the Eastern States of the United States so far as interchangeability of license is concerned, such as purchasing a New York State license and wanting to take a trip to Birmingham, Ala.? Is it possible to travel through New Jersey, District of Columbia, Maryland, Virginia, North Carolina, South Carolina and Tennessee with a New York license?

Pedro Miguel, C. Z. L. DE LYON, V. V.

—The New York State license will carry you through all the States you mention, provided you do not stay in any longer than 10 days.

Interconnecting Buick Brake and Clutch

Editor THE AUTOMOBILE:—Referring to the model 10 Buick, what is the best way to interconnect the brake and clutch so that the latter will be disengaged before the former is applied?

I would like to make this change and feel that the necessary attachment should be preferably applied to the service brake. No doubt this point has been raised before and you have a ready solution of the problem. Perhaps you know of some device now manufactured for this purpose.

Kindly publish a sectional drawing of the clutch and transmission used in this car.

Hollis, L. I. R. M. DEV.

—In regard to interconnection of brake and clutch on the model 10 Buick this can be accomplished by welding or brazing a large washer on the front end of the rod which connects the high speed lever with the foot control shaft and by inserting a special large-headed pin in the foot brake lever. When the pedal is depressed, this pin will engage with the washer on the high-speed rod thus throwing out the high speed clutch when applying the brakes. At one time, a number of concerns had devices of this nature on the market, but THE AUTOMOBILE has no record of any now for sale. The gearset and clutch assembly for this model is illustrated in Fig. 1.

Information on Owen Magnetic

Editor THE AUTOMOBILE:—In the issue of July 15, page 102, there is a description of the Owen Magnetic drive car. Where, by whom and for what length of time has the Owen Magnetic been made? What is the highest speed?

2—What is the life of the magnetic transmission as compared with the ordinary and friction drive?

3—Could this transmission be put on another car?

4—What does the Owen Magnetic chassis sell for?

Kansas City, Mo. J. W. A.

—The Owen Magnetic cars are made in New York City, by R. M. Owen & Co., and have been on the market for about two years.

2—The magnetic transmission has not been on the market long enough to give any clue as to its ultimate life.

3—This transmission system can be put in another car, but this would be a wasteful operation and would not pay.

4—The price of the Owen Magnetic chassis alone is $3,150. For the complete car the price is $3,750.

M.E.P. Is Mean Effective Pressure

Editor THE AUTOMOBILE:—What is a T-head motor?

2—How can I secure the A. A. A. rules?

3—Is there a company prepared to fit front wheel brakes to a 1916 Chandler?

4—What does M.E.P. mean?

Cambridge, Mass. J. A. J.

—A T-head motor is one in which the exhaust and intake valves are on opposite sides of the cylinder. Two camshafts are generally employed with this arrangement.

2—The contest rules of the A. A. A. can be secured from the American Automobile Association, 437 Fifth Avenue, New York City.

3—THE AUTOMOBILE has no record of any concern prepared to fit front wheel brakes to a 1916 Chandler. This would be a very costly and complicated operation and it is doubtful if it would be possible to secure a practical job.

4—The initials M.E.P. stand for the mean effective pressure. It is secured by dividing the summation of the pressures at all points of the stroke by the length of the stroke.

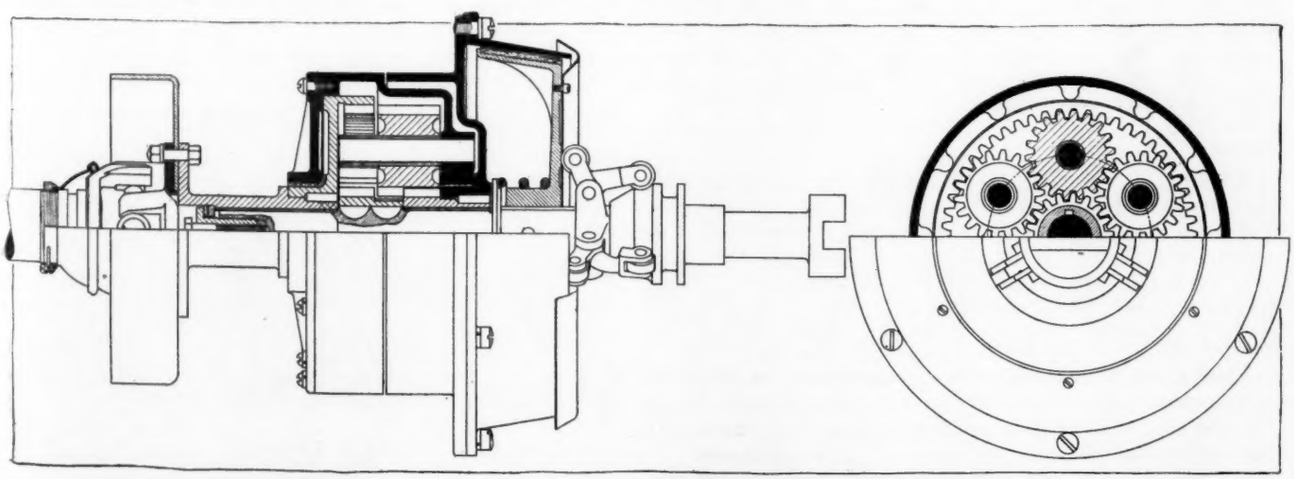


Fig. 1—Gearset and clutch assembly of Model 10 Buick in part sectional side and end views

The six cars coming into the stretch for the flying start of the 100-mile race for the Harkness gold challenge cup and $12,000 prizes. Left to right, they are: Mulford, Peugeot; Burman, Peugeot; Rickenbacher, Maxwell; Aitken, Peugeot; Resta, Peugeot; and De Palma Mercedes. As they swept up to the line the thousands of spectators in the stand burst into cheers

Resta Takes Harkness Cup Race at 105.39 M. P. H.

On Sheepshead Bay Track His Peugeot Comes Within 26 Sec. of Breaking 100-Mile World's Record Made at Brooklands

De Palma Wins Match Race with Burman in Two Heats, the First at 111.97 and the Second at 113.86 M. P. H.

Order of Finish in Harkness 100-Mile Gold Cup Race

Car	Driver	Time	M.P.H.
Peugeot	Resta	56:55.71	105.39
Peugeot	Burman	58:38.95	102.43
Maxwell	Rickenbacher	61:00.59	98.33

SHEEPSHEAD BAY SPEEDWAY, Nov. 2—Dario Resta to-day won the final speedway event of the year by winning in his Peugeot from a field of six of the picked drivers of the country in the 100-mile race for the Harkness gold challenge cup, on the 2-mile board speedway here. Besides the laurels of victory Resta, by going the distance in 56 min. 55.7 sec., without having to make a single stop, established a new American record for the century and came within 26 sec. of beating the world's record for the distance made on the Brooklands cement speedway in England some years ago. The Brooklands record is 56:29.93, or only 25.78 sec. faster than Resta's mark of to-day. Resta's average here to-day was 105.39 m.p.h.

Burman Second at 102.43

Second place was taken by Robert Burman in another Peugeot, Burman finishing a little over a lap behind the winner, but doing the distance in 58:38.95, an average of 102.43, and beating the mark that Resta made in the 100-mile match race on the Chicago speedway some months ago. Burman had to stop once for a right rear tire which lost him a lap.

Rickenbacher in Third Place

Third place went to Edward Rickenbacher in a Maxwell, who made a non-stop race but whose car was not fast enough for the company. Rickenbacher averaged 98.33 m.p.h., his time being 61:00.59.

Six racers started, the field being made up of four Peugeot cars, one Mercedes and a Maxwell. Resta, Burman, Mulford and Aitken drove Peugeots; De Palma handled the Mercedes and Rickenbacher the Maxwell. Aitken, after leading from the start, was forced out at 12 miles with a broken connecting-rod. De Palma was out at 40 miles, having made two stops for carburetion, his first stop coming at 24 miles. Ralph Mulford, who was the pace setter after Aitken was eliminated, was the hard luck tire driver of the race until at 92 miles when he went out with a broken connecting-rod. Mulford had the fastest car in the race but his speed cost him tires and he stopped regularly at 25-mile intervals to change his right rear. The first change was made in 21 sec. at the end of 28 miles; the second change was at 50 miles; and the third change at 76 miles was made in 23 sec. The fourth time he changed both rears in quick time. Each stop put him back more than a mile, due to time lost in slowing up. In the middle of the race he regained from Resta more than a mile of lost distance but in doing so he brought more tire changes for the right rear, the tire that gave him the most trouble.

While Mulford and Burman were wrestling with tire

The leaders closely bunched at 10 miles as they shot into the grandstand stretch. Left to right, Aitken, Peugeot; Resta, Peugeot; Burman, Peugeot, and De Palma, Mercedes

troubles Resta was going along at an amazingly steady pace of a little over 105 m.p.h., which he set from the start and did not vary at any one of the 10-mile points.

The start was a flying one with De Palma in the favored position at the pole and with the order outside of him Resta, Aitken, Rickenbacher, Burman and Mulford. In the first lap De Palma put his Mercedes in the lead in the first turn but Aitken took the lead in the backstretch and when they crossed the tape at the end of the initial lap the order was Aitken, Mulford, Resta, De Palma and Burman, with Rickenbacher trailing. Aitken at once established himself in the lead with Resta and De Palma close up, which order continued until 12 miles when Aitken was out and at this point Mulford had passed Resta and took the leadership, with Resta, Burman and De Palma all bunched 100 yd. back of him. Soon, Mulford had 200 yd. on this trio and a few laps later Mulford was more than the length of the homestretch in the lead. Mulford was making lap after lap at 108 m.p.h., when his first tire went and he was placed back nearly a lap, giving the leadership to Resta at 28 miles. Mulford's average at 20 miles was 105.18 m.p.h.

Tires the Determining Factors

With Resta slightly in the lead at this point due to Burman, Mulford and De Palma all stopping between 24 and 28 miles, the tense interest of the race ended and everybody sat back waiting for tires to become the deciding factors, as they did. Good judgment and fortune favored Resta as they did in the Chicago 100-mile event and he was an easy winner, finishing more than a lap ahead of Burman.

At the end of the first 10 miles Aitken's Peugeot led, having averaged 102.62 m.p.h. When 20 miles had been covered Mulford was ahead with a speed of 105.18. At 30 miles Resta had worked his way to the front, his average standing at 105.36. He held this position during the remainder of the race, his average speed in m.p.h. at each 10 miles being as follows: 40 miles, 105.88; 50 miles, 105.57; 60 miles, 105.31; 70 miles, 105.39; 80 miles, 105.53; 90 miles, 105.57; and 100 miles, 105.39.

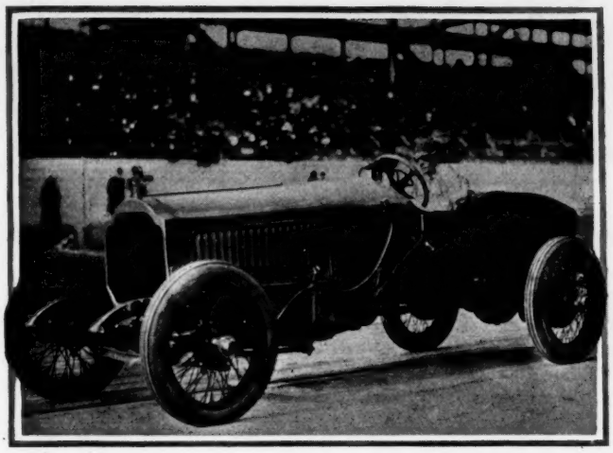
De Palma and Burman in Match Race

In addition to the 100-mile race there were two heats of 4 and 6 miles, respectively, between De Palma in the twelve-cylinder Sunbeam, which the Packard company purchased some months ago and Burman in the Blitzen Benz. These races were the most exciting of the afternoon, the finishes being so close that one car was alongside of the other. De Palma won both, taking the 4-mile heat in 2:08.61, an average of 111.97; and taking the 6-mile heat in 3:09.65, an average of 113.86 m.p.h. In these heats the cars were rarely more than a few lengths apart. On the turns De Palma, with the pole position, ran low, while Burman rode high, losing a length or so but coming into the stretches at terrific speed and going alongside and in a few instances passing De Palma, only to drop back a little on the turn. At the finish the front wheel of the Benz was alongside the rear wheel of the Sunbeam. The Sunbeam has cylinders 80 by 150 mm., giving a piston displacement of 549 cu. in. The car weighs 2800 lb., has 120-in. wheelbase and used 32 by 4½ tires. The cylinders are cast in groups of threes and arranged in conventional V groups.

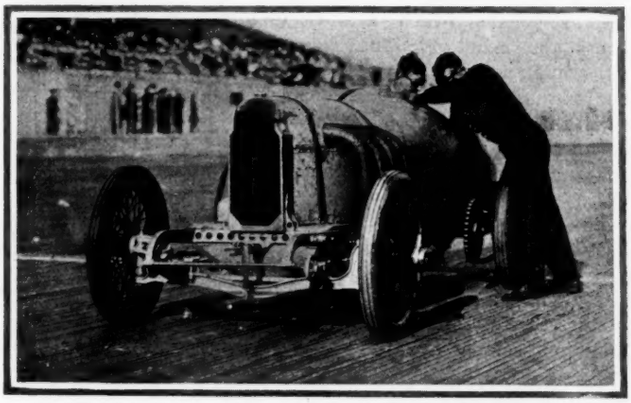
Burman's 2-Mile Trial

A third feature of the afternoon was a 2-mile exhibition by Burman in the Benz in which he was unofficially clocked at a speed of 116 m.p.h., which, if official, would establish a new American record for that distance.

Jesse G. Vincent, chief engineer and vice-president of the Packard company, drove a Packard twin-six with racing body a 2-mile lap in 1:10.52, a speed of 102.25 m.p.h. The car was standard except the timing was changed for higher speed; pistons were arched on top to give higher compression; a double Zenith carbureter was used and the rear axle gear ratio was to give 34 m.p.h. at a crankshaft speed of 900 r.p.m. Mr. Vincent says the crankshaft speed was 3000 r.p.m. on the backstretch.



The Packard twin six which J. G. Vincent, vice-president of engineering of the Packard company, drove around the 2-mile Sheepshead Bay speedway in 1:10.52, or at the rate of 102.25 m.p.h. This is a stock car except for the racing body and that the timing was changed for high speed work, the pistons were arched on top to give higher compression, a double Zenith carbureter was used and the rear axle was geared to give 34 m.p.h. at a crankshaft speed of 900 r.p.m.



Burman giving his Blitzen Benz a few preparatory touches just before the start of the match race with Ralph De Palma in the twelve-cylinder Sunbeam. De Palma won the first heat of 4 miles, two laps of the track, in 2:08.61, or at 111.97 m.p.h., and the second heat of three laps, 6 miles, in 3:09.65, or at the rate of 113.86 m.p.h.

In the 100-mile event Zenith carbureters were used on all six cars, as were Bosch magnetos and Silvertown cord tires. Wire wheels were used on all cars.

In the way of lubrication, Resta, Burman, Rickenbacher, Mulford and Aitken used Oilzum and De Palma used Monogram. Boyce Motometers were used by all the cars in the 100-mile race.

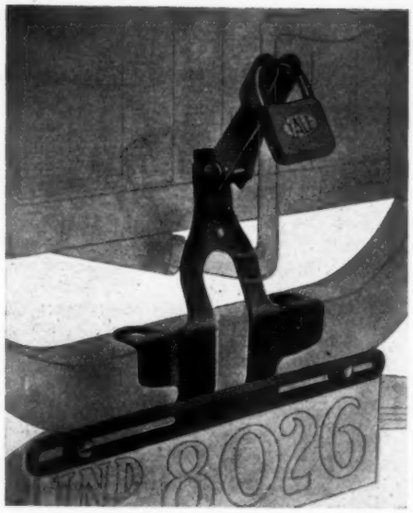
The piston displacement of the Peugeots driven by Resta, Mulford and Aitken is 274 cu. in., and that of Burman 296. The Maxwell is 298. The Blitzen Benz has four cylinders 7 5/16 by 8 in., and is one of the biggest racing motors of the day. The car weighs 2800 lb., is chain driven, uses a Benz carbureter, two Bosch magnetos, and carries 33 by 4 and 33 by 5 tires, front and rear. It is geared 1 to 1 between the motor and the rear axle.

The day was very windy and rather cold, increasingly so as the shadows began to lengthen toward the close of the 100-mile race but in spite of these conditions a crowd of over 25,000 thronged the stands and hundreds of cars were parked within the inclosure.

ACCESSORIES

Oakes Kranklock for Fords

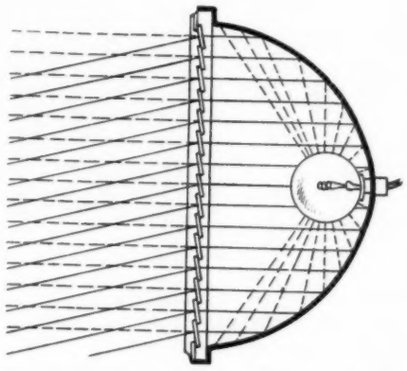
THE Kranklock is a combination starting crankholder and license plate bracket designed to fit on the center bolts of the Ford front spring, making its attachment simple and rigid. Its advantages are that it holds the starting crank upright and rigid as shown in the accompanying illustration, that it can be locked, thus making the car theft-proof and also that it holds the license number securely in a correct position.—The Oakes Co., Indianapolis, Ind.



Oakes Kranklock for Fords, illustrating mounting

Opalite Glare Deflector

This device consists of a series of Parolin prisms which run diagonally across the headlight lens, each prism overlapping the top of the one below it, the prisms being arranged at such an angle that proper deflection and diffusion of the light rays result, thus overcoming all blinding glare. The manufacturers state that the device will not break, even if the headlight glass is shattered and emphasize that it kills the glare from the lamp but not the light, simply softening the beams without impairing the illumination of the road. Opalite is made to fit all makes of lamps, is permanent and positive in action and is adjusted in a few moments.—Price $2 per pair.—M. & K. Auto Sundries Co., New York City.


Opalite headlight glare deflector, showing action

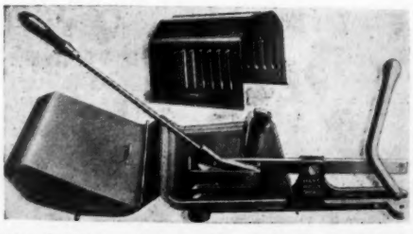
Micalite Fireproof Celluloid

A fireproof celluloid under the trade name of Micalite has been placed upon the market and is being manufactured in transparent sheets which are being used in the Micalite eye shield. Another interesting feature of the material is that although it has been generally understood that such a material as Micalite could not be stained it is being produced in colors suitable for use in goggles, namely, amber in a light shade or amber in two shades in one piece. This development has made possible the all-one Micalite eye shield which is now regularly marketed. The darker part is intended for the brightest lights and the lighter part for ordinary use.—Strauss & Buegeleisen, New York City.


Micalite eye shield of fireproof celluloid

Mayo Louver Cutter

A device for cutting louvers or ventilating openings in the bonnets of cars has been put out under the name of the Mayo louver cutting machine. It is intended for garage men who can solicit the work of cutting these louvres in the hoods of cars in their vicinity. The machine which is shown in the accompanying illustration is strongly constructed with hardened tool-steel cutters for left and right sides of the hood. The cutters can be removed and sharpened. The complete machine weighs 45 lb. and the dealers' price is $30 net.—Mayo Mfg. Co., Chicago, Ill.


Mayo louver cutter and results it produces

Arguto Wood Bushings

These oilless bushings are designed for shop work where oiling is objectionable or difficult, the wood being chemically treated so that lubrication is unnecessary, making it especially well adapted to loose pulley work, where centrifugal force throws oil out of the ordinary bearing. Arguto bushings are not recommended for heavy line shafting, because wood is not strong enough to withstand the stresses but for countershafts, light line shafting and similar work the wood gives excellent results, the makers citing instances where these bushings have been in satisfactory use for periods up to nine years. When using the Arguto bushings the shaft is lightly smeared with a lubricant, largely as a rust preventive in case the shaft is not immediately operated. For loose pulleys on grinding machinery these bushings have the advantage that they run perfectly dry and cannot gather abrasive dust. The coefficient of friction is about the same as that of ordinary metal line shaft bearings.

Cylindrical bushings are furnished from ¼-in. bore 1 in. long to 3-in. bore 16 in. long, the smallest size listing at 5 cents each and the largest at $4.50.—Arguto Oilless Bearing Co., Philadelphia, Pa.

Holdfast Nut

Holdfast nuts are made by a chemical welding process, the threads of standard size nuts being coated with a soft friction metal which grips the threads of the bolt and holds them tightly. A special tap is used to remove part of the soft metal from the bearing or load surface of the thread after the soft metal coating has been applied, leaving the metal on the clearance side. The nuts are applied in the ordinary way and can be used several times before wearing out the soft metal coating. Any size, style or grade can be furnished.—Holdfast Nut Co., Chicago, Ill.

Beamish Lunch Bag

The Beamish bag for cold lunch is of strong paper stock, the lower part being of heavy manila tag stock, the entire bag being paraffined to make it waterproof. The makers state that it will keep cold lunches clean and moist for a long time and that bottles packed in the bag with ice will keep cold for twelve hours. Each bag may be used several times. Price 10 cents each.—Beamish Glass Co., Kansas City, Mo.

The Automobile

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Cylinders Once More

IN automobile development it seems fated that there should always be cylinder factions. We began with one versus two, had an interval of two or three and then a long session of two or four. Then came a general acceptance of four, followed by more argument with the coming of the six. It was soon seen that both four and six had their legitimate spheres and the argument died away. Now, in one short year, we have both the eight and twelve providing a new three-cornered problem with the six for the other side of the triangle.

It is devoutly to be hoped that we shall not see engineers split up into groups over this new phase, because such grouping injures progress. The proper state for an engineer is that of the open mind; to assume the newest thing is good until it is proved instead of expecting failure until disproved. There is a great big difference between these two ways of looking at a thing, and one stands for progress while the other does not.

Marvelous Motor Progress

THAT 1915 has seen a more rapid development of the gasoline engine than any previous period of three times the length is undeniable. The high efficiency engine has been known for several years, though exploited but little in America; the eight and twelve-cylinder motors were practically not known anywhere. Now, in a single year our engineers have accepted and adopted high efficiency design and added to it the novel types of motor. Most remarkable of all, perhaps, is the fact that everyone from manufacturer to user is satisfied with the success of the engineers' work.

Not long ago engineering progress was undoubtedly retarded by the notion that rapid engineering development was uncommercial. The results of this year's business shows rather that engineering advance is one of the greatest assets of the industry. The automobile of 1916 is a far better car than the machine of two years ago, it is selling in far larger quantities, it is costing less to run and it is attracting more and more of the population to become automobile owners. Thus the first time for many years that the engineers have been given a free hand they have shown how great the part they play in stimulating sales directly.

Racing Car Making

THE recent editorial in THE AUTOMOBILE, Wanted! Racing Cars, has stimulated a good deal of correspondence which goes to show that the problem of supplying good cars to fill our speedways next year is being considered in many quarters. The general idea seems to be that the popularity of racing may create more small firms who will specialize solely on racing chassis and cater solely to the speedways, but the point first requiring to be settled is whether a sufficiently reliable market is assured.

There is obviously a very widespread feeling that the prize money needs to be distributed so that car builder and driver are no longer dependent upon winning or coming close to winning if they are to see any return for their work. The stars may draw their tens of thousands, but the chorus is also deserving of its hire.

With this view it is impossible to dissent, however hard it may be to devise a means for readjustment that will please everyone, and it is now the turn of the speedway organizations to offer a suggestion. Why not appoint a joint committee of the A. A. A., manufacturers, speedways, entrants and drivers and get something settled before the dawn of 1916?

Automobile Reserve Corps

THE ostensible purpose of the establishment of an Automobile Reserve Corps in this country is to provide a volunteer transport service, trained and ready at a moment's notice to mobilize or concentrate our small army. This should make our fighting force marvelously mobile, for we have many more automobiles available than all Europe could claim at the opening of the great war. Incidentally this Automobile Reserve Corps, with each recruit a unit in an active national patriotic organization, should raise the standards of citizenship. There are many motorists who do not feel competent to shoulder a gun. They feel no sense of duty other than at the polls.

Chandler Stock Now $10,000,000

New Régime To Increase Yearly Car Output from 9000 to 20,000

NEW YORK CITY, Nov. 1—A new régime in the Chandler Motor Car Co., Cleveland, Ohio, has been started by an increase in the stock of the company from $425,000 to $10,000,000, this increase being all common stock which is being put on the market by Hornblower & Weeks, 42 Broadway. This additional common stock is not all being sold, $3,000,000 being held for future sales. It is understood that Hornblower & Weeks have sold all the remainder already at 85. The stock will soon be listed on the exchange.

By this new financing scheme the capacity of the Chandler factory it is expected will be increased to 20,000 cars to be built in the next twelve months. There were 9000 cars built during the last year. Under the new financing the control and management of the company will remain with the old stockholders, and the majority of the board will be made up of the old Chandler organization, including F. C. Chandler, president; C. A. Emise, vice-president; W. S. Mead, vice-president; and Samuel Rogers, treasurer. The proceeds of the sale of new common stock will be used for increasing the factory capacity. During the last four months one factory addition has been under construction and is now nearing completion which will double the capacity of the factory.

Since its inception the rise of the Chandler factory has been one of the spectacular developments of the automobile industry, particularly in that field where price has been in the zone between $1,200 and $1,700. The Chandler six was announced in February, 1913, at the Chicago show. The feature of its announcement being the first six-cylinder car to be marketed in quantities at a price of $1,750. Two years later at the Chicago show, 1915, the motor car field was further electrified when the price was reduced to $1,295 which set a new low figure for a car of its class.

During the past year the stockholders of the Chandler company have received 100 per cent cash dividend on their common stock and the regular 7 per cent dividend on the preferred.

—

Maxwell to Aid Dealers' Finances

DETROIT, MICH., Nov. 1—*Special Telegram*—The Maxwell Motor Co. has decided to use part of its surplus by making deposits in banks in different parts of the country where Maxwell dealers are located and enable the latter to get loans from the banks in order to be able to pay cash for cars ordered in December, January and February, during which months sales are almost always at a minimum. The arrangement between the banks and the Maxwell company is to be with the understanding that the dealer will be given credit equal to the company's deposit, the interest to be not more than 6 per cent. The dealer is to put up from his own resources about one-fourth of the purchase price while the balance will be made up from the loan, thus enabling cash payment on delivery of the cars. Certificates of deposit bearing 3 per cent interest will be accepted by the Maxwell company, the deposits being made for six months. The certificates will also be negotiable by special arrangement between the company and its banks. The dealers' notes will be collected by his bank.

—

Studebaker To Retire All Serial Notes—$2,300,000

DETROIT, MICH., Oct. 30—The Studebaker Corp. has decided to retire all of its outstanding serial notes, amounting to $2,300,000, although the last of them are not due until 1922. For this purpose the 20,684 shares of common stock held in the corporation's treasury, will be offered to common stockholders of record at the close of business Nov. 20, at $110 a share, on the basis of 7 per cent of their holdings. In other words if a stockholder has 1000 shares of common on Nov. 20, he can buy seventy shares of the stock now in the treasury at $110 a share.

After the retirement of these notes the Studebaker Corp. will have no debts excepting current accounts and its working capital will be $22,050,000 of which $6,500,000 is cash. It is expected that the special surplus account used for amortization of preferred stock will soon total $2,500,000 which will then make it possible to declare more than 6 per cent dividends. The corporation's charter provides that only after the surplus has reached that amount can a dividend in excess of 6 per cent be paid.

—

Safford McQuay-Norris V. P.

ST. LOUIS, MO., Nov. 1—L. A. Safford, formerly Chicago manager of the Chilton Co., publishers, of Philadelphia, Pa. has been made second vice-president of the McQuay-Norris Manufacturing Co. of St. Louis.

—

Cotton F. W. D. Advertising Manager

CLINTONVILLE, WIS., Oct. 29—J. D. Cotton has been appointed advertising manager of the Four Wheel Drive Co., Clintonville, Wis., and has already taken up the duties of the advertising and promotion department.

H. W. Ford Controls Saxon Co.

Buys Hugh Chalmers' Stock—$500,000 Involved—To Build 28,600 Cars

DETROIT, MICH., Oct. 30—Harry W. Ford, president of the Saxon Motor Co. has purchased all the stock which Hugh Chalmers, president of the Chalmers Motor Co. held in the Saxon company. The deal involves a cash transaction of half a million dollars and makes Mr. Ford the largest individual stockholder in the Saxon company, of which the original stockholders were, besides Mr. Chalmers and Mr. Ford, Lee Counselman, Percy Owen, Geo. W. Dunham, H. H. Pinney, C. A. Pfeffer, C. A. Woodruff and C. C. Hinckley, the latter four having disposed of their interests some time ago. The manufacturing schedule of the Saxon company for the present season calls for a production of 28,600 cars.

Harry W. Ford came to the Saxon company through Mr. Hugh Chalmers. He worked in the advertising department of the National Cash Register Co., Dayton, Ohio, while Mr. Chalmers was general manager of the company. When the latter organized the Chalmers Motor Co. he asked Mr. Ford to join him and put him in charge of the advertising department of the new company. When the Saxon Motor Co. was organized by Mr. Chalmers and other Chalmer's officials they chose Mr. Ford as president of the new concern.

—

Overland Sales 100% over Oct., 1914

TOLEDO, OHIO, Oct. 28—President J. N. Willys in a statement at the annual meeting of the Willys-Overland on Oct. 26, stated:

"August and September shipments increased 400 per cent over the same months of a year ago. October sales increased 100 per cent over October a year ago. New buildings are now practically completed which will permit an increase in output to 1000 cars a day by March 1, which, from present indications, will be fully required to produce new models planned for 1916. The Willys-Knight deliveries are 40 per cent greater than we had planned."

—

Alter Price Remains Unchanged

PLYMOUTH, OHIO, Oct. 28—The Alter Motor Car Co. has brought out its 1916 model with few changes. The price of the car is $685, the same as last year. This includes starter, one-man top, electric lighting, horn, etc. The wheelbase has been lengthened to 108 in. and 32 by 3½ in. demountable rims are added.

Sept. Exports Are $10,711,133

Over $1,000,000 Better Than Aug.—Trucks Total 2227 and Cars 4299

	September, 1914		September, 1915	
	No.	Value	No.	Value
Cars ..	646	$597,904	4,299	$3,215,459
Trucks..	128	294,288	2,227	5,882,255
Parts ..	...	34,618	...	1,613,419
Total. ...		$926,910	...	$10,711,133

WASHINGTON, D. C., Oct. 31—Exports of automobiles, trucks and parts during September, 1915, showed a value of $10,711,133. This is quite an increase over the previous month's figures, which were $9,567,348 and over September, 1914, with only $926,910.

Trucks, numbering 2227 and valued at $5,882,255 and cars, numbering 4299 and valued at $3,215,459 with $1,613,419 in parts, were exported.

Both cars and trucks increased in number over August. One interesting point brought out in the above table is that though the number of cars shipped in September increased 460, the value only increased $93,265, showing the September shipment included cheaper-priced cars than those shipped in August. The number of trucks increased 613 and the value $1,495,062.

There was a drop in parts shipments, which amounted to $1,613,419 as compared with $2,038,321 in August.

—

Firestone and Miller Tire Companies Plan Additions

AKRON, OHIO, Oct. 30—The Firestone Tire & Rubber Co. and the Miller Rubber Co. will soon add to their plant outputs with new buildings. The new Firestone plant will be erected on the east side of Main Street, opposite the present plant. The Miller company is planning a new factory, the permit for which will be issued in a few days. This new building is the third to be started within the past six months.

A permit for the erection of the Firestone clubhouse has been issued. The new building will cost $85,000.

—

Paige Sales for October Show 600 Per Cent Increase

DETROIT, MICH., Oct. 31—During the first fifteen days of October, or thirteen actual working days, more Paige cars were shipped than in any other period in the history of the Paige-Detroit Motor Car Co. October sales show an increase of 600 per cent over October of last year.

—

500 Men Rush New National Plant to Completion

INDIANAPOLIS, IND., Oct. 30—More than 500 men are working overtime in order to complete the new plant of the National Motor Vehicle Co. Operations in the new building are expected to commence in about sixty days. The company is spending about $100,000 to enlarge its plant, and the new buildings are two stories high and 678 ft. in length. This means that the length of the additions is approximately two city blocks.

—

Chevrolet Cars To Be Assembled in McLaughlin Plant

FLINT, MICH., Oct. 30—The Mc-Laughlin Carriage Works, Oshawa, Canada, have completed an arrangement with the Chevrolet Motor Co. of Delaware, whereby their big carriage plant in Oshawa will be turned into an assembling plant for Chevrolet cars. At the same time the McLaughlin concern takes charge of the Chevrolet Motor Co. of Canada, recently formed to operate a plant in West Toronto. Thus the Crevrolet business in Canada will be controlled entirely by the McLaughlins.

Through the new arrangement it will now be possible to increase the production of Chevrolet cars in Canada from 5000 to 12,000 for the season of 1916. An output of 20,000 has been planned for 1917, it is said.

The McLaughlins have a controlling interest in the McLaughlin Motor Car Co., Ltd., which assembles and sells the Canadian Buick, the General Motors Co. having the balance of the stock.

—

King Has Improved Model

DETROIT, MICH., Nov. 1—The King Motor Car Co. has announced an improved model five-passenger, eight-cylinder King at $1,150, f. o. b. Detroit, $200 less than the King eight brought out a year ago.

The new car has a larger motor, 2⅞ in. by 5-in. stroke. Other modifications include a larger carbureter, refinements in lubrication, radiation and ignition. The main points in the design are unchanged. Color has been changed from blue to a salon green body and hood, with black fenders, running gear and wheels; with a fine gold stripe.

—

Kelly and Springer Return

NEW YORK CITY, Oct. 28—John H. Kelly, sales manager of the Republic Rubber Co., Youngstown, Ohio, accompanied by Frank V. Springer, export manager, returned on the Adriatic to-day from a two months' trip in Europe.

—

Porter Rubber Plant in Salem

SALEM, OHIO, Oct. 30—The Porter Rubber Co. has been organized with a capital of $125,000, and will erect a plant in Salem. The officers elected are as follows: President, J. C. Porter; vice-president, T. H. Boyd; treasurer, E. E. Boyd.

Peerless and General Veh. Co. Sold

New Corp. To Take Over Both —Trucks and Motors To Be Made

NEW YORK CITY, Nov. 3—The Peerless Truck & Motor Corp. has been formed in this city to-day to acquire the Peerless Motor Car Co., Cleveland, Ohio, and the General Vehicle Co., Long Island City. Nothing definite as to the capitalization or plans of the new corporation is at present known but it is understood the manufacture of commercial vehicles will be continued and that the manufacture of passenger cars at the Peerless factory is assured as an eight-cylinder car will be brought out in the near future. The General Vehicle Co., through its agreements with the Mercedes company in Germany has control of certain aviation features which it is expected will be developed and vigorously pushed in this country.

The exact personnel of the Peerless Truck & Motor Corp. is not known, but it is expected that it is closely allied with the electrical interests which secured control of the Peerless company over 3 years ago.

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Gasoline Shortage in Paris Threatens to Stop Taxicabs

PARIS, Oct. 23—The shortage and high price of gasoline in Paris has become so serious that the taxicab service is threatened with a stoppage. The municipal authorities have taken the matter up, but have not yet arrived at any decision other than a statement that drivers are not allowed to change their rate of fares without giving official notice and changing the color of the taximeter flag to correspond with the scale they are using.

It was generally reported that the high cost of gasoline was due to the large requisitions made by the military authorities, but according to an official statement no extra requisitions have been made. This statement is not generally believed. One of the explanations given by the refiners is that they are unable to get the tank boats which normally bring gasoline up the Seine to Paris. The Roumanian and Russian supply of gasoline has been cut off, but this only represented 20 per cent of the whole, the remaining 80 per cent coming from America. It is known that there is no shortage of gasoline for military purposes; in certain cases soldiers report they are so well supplied they can wash their clothes in gas. As gasoline has now become a first necessity, all civilian users are asking if it is not possible to give them greater consideration without hampering the military.

Canadian Ford Profits $3,202,458.15

Annual Statement Shows Gain of $1,179,962.09 Over 1914 —Cash $2,609,997.65

FORD, ONT., Oct. 26—The annual financial statement of the Ford Motor Co. of Canada, Ltd., shows that during the fiscal year ending Sept. 30, 1915, the company made a net profit of $3,202,458.15 or an increase of $1,179,962.09 over the profit of 1914.

The assets totaled $9,182,408.30 as compared with $5,603,618.41 in 1914, an increase of $3,578,789.89 for the year just ended. Among the items enumerated the one showing the biggest increase is that of cash on hand or in the banks, which totaled $2,609,997.65 or nearly $1,400,000 more than in 1914. An increase of nearly $1,000,000 is also shown for the home plant's value, which is given at $2,743,112.07 as against $1,875,114.36 in 1914. For branch plants there is shown an increase of over 100 per cent. Accounts receivable which were marked down for $347,149.17 in the 1914 report now show a total of over $1,000,000 of which over half represents foreign accounts.

Among the liabilities all the items with the exception of one show big increases, this one exception being the dealers' contract deposits with which is also included miscellaneous credits. The total is $115,884.68 or about $1,000 less than the previous year.

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Charges Fraud in Fender Test

CHICAGO, ILL., Nov. 2—Suggestions of bribery and fraud in the conduct of fender tests for the city of Chicago may result in throwing considerable light on the conduct of the so-called tests of safety fenders, which have been going on in Chicago. H. L. Eisenhauer, president of the Telescopic Fender Co., made charges before the judiciary committee of the city council yesterday, which involved Emanuel Freidlander, president of the Fender Manufacturers' Association. It is expected that these will result in an airing of the conditions in the fender tests, as information, it is understood, is to be placed in the hands of the State attorney.

Eisenhauer's attorney paved the way for the disclosures by making insinuations regarding the good faith of the committee which has been testing truck fenders under the direction of the deputy superintendent of police. The tests were made for the purpose of recommending to Chief Healey, which fender should be approved by the police department, as complying with the fender ordinance passed nearly a year ago. Eisenhauer said he paid $300 to Freidlander, the first $100 of which was to be paid over to the city to meet the cost of the test. In accordance with Freidlander's statement all the business is being done between the fender association and the testing committee. Eisenhauer said that Freidlander gave him a receipt and a written guarantee that he would get a certificate of approval of the fender or receive his money back. The second $100, according to Eisenhauer, was to assure the passage of the fender, and the third $100 was paid on the representation that the association needed the money and that "everything was fixed."

It seems that the telescopic fender has not been approved as yet, hence the disclosures. The deputy superintendent of police, in charge of the tests, claims that the Eisenhauer payment of the second $200 was for the purpose of bribing one of the committee but it was unsuccessful. The Standard Fender Co., a member of the association, is the only concern thus far which has received the approval of the committee. The chief of police, however, has not issued a certificate to the Standard company and the latter is complaining because the certificate is held up. The Standard Fender Co. is represented by attorney Frank L. Childs, who, by the way, is the attorney for the Chicago Motor Club. The chief of police has withheld the issuance of the certificate to avoid creating anything like a monopoly.

Ford Motor Co. of Canada, Ltd., Balance Sheet for Fiscal Year Ending Sept. 30, 1915

	1915	1914
ASSETS		
Cash on hand and in banks	$2,609,997.65	$1,257,032.35
Accounts receivable	1,027,573.17	347,149.17
Prepaid expenses	178,167.67	127,707.69
Inventories or stores accounts	1,649,078.40	1,513,695.17
Home plants, including buildings, machinery, equipment, etc.	2,743,112.07	1,875,114.36
Branch plants	974,479.34	482,919.67
Total	$9,182,408.30	$5,603,618.41
LIABILITIES		
Accounts payable	$874,848.33	$284,621.00
Accrued payroll and miscellaneous	133,088.53	64,207.00
Dealers' contract deposits and miscellaneous credits	115,884.68	116,679.00
Contract rebates	89,496.74	34,600.00
Reserves	439,289.51	276,166.00
Profit and loss	3,202,458.15	2,022,496.06
Surplus	3,327,342.36	1,804,846.35
Capital	1,000,000.00	1,000,000.00
Total	$9,182,408.30	$5,603,618.41

$3,000,000 Co. to Build Lozier

Property Bought by Assoc'd. Lozier Purchasers—New Interests Elect Officers

DETROIT, MICH., Oct. 29—With a capital stock of not less than $3,000,000 the Lozier Motor Co. will be re-organized and will continue to make Lozier cars as a going concern.

Two of the big stockholders, Maurice Rothschild and Charles Shongood, who were vice-presidents of the company, and who were among those who purchased the assets of the old concern, have withdrawn from the company and disposed of all their holdings to Theodore Friedeberg, Harry and Samuel Frank, who now control all the stock of the company.

The reason of the withdrawal of Mr. Rothschild is due to the fact that he is affiliated with the Harris Bros. Co., Chicago, which firm is commonly known as the Chicago Housewrecking Co. It caused people to believe that these firms were actually interested in the Lozier company and intended only to continue the business for liquidation purposes, which has not been the intention of the purchasers of the old concern.

As evidence that the business is to be continued, a deal was completed a few days ago between the present stockholders and the Detroit Trust Co., trustee in bankruptcy for the former bankrupt concern, whereby the real estate and plant here in Detroit, upon which the Associated Lozier Purchasers had an option, has been purchased by the latter, after the proposition had been submitted to the United States district court and approved by it.

The officials of the Lozier Motor Co. are, Theodore Friedeberg, president; Harry Frank, treasurer and Samuel Frank, secretary and general manager. U. G. Thomas is factory manager.

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Steel Horse Farm Tractors

MILWAUKEE, WIS., Nov. 1—The Steel Horse Co. of Milwaukee plans to manufacture a general utility gas tractor. The company is capitalized for $25,000 and is backed by William B. Reith, Walter D. Mann and Adolph C. Graf. The tractor is designed especially for farm use and will haul a plow, cultivator, seeder, harrow or other light farm implements and can be used for light haulage of other kinds.

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Ainsworth Mfg. Co. Organized

DETROIT, MICH., Oct. 30—The Ainsworth Mfg. Co. has been incorporated with a capital of $100,000 for the pur-

pose of manufacturing automobile accessories such as windshields, etc. The principal organizer of the company is Harrison Ainsworth, for many years with the Rands Mfg. Co. and with the Rover Motor Co., Coventry, England. He will be secretary-treasurer while Clarence H. Booth, formerly general manager of the Studebaker Corp., is the president. Others interested in the concerns are: George W. Golden, of Golden, Belknap & Swartz; L. D. Bolton, Detroit representative for the Brown-Lipe Co.; Alonzo P. Ewing, of the Detroit City Gas Co.; R. J. Purdy, mechanical engineer. For the present the plant will locate at Franklin and Dubois Streets, occupying 25,000 sq. ft. of floorspace in the old Ideal Mfg. Co. plant.

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Regulate Bay State Headlights

BOSTON, MASS., Nov. 1—Regulations for automobile headlights have been formulated by Massachusetts Highway Commission, making them effective Jan. 1, 1916. The regulation reads as follows:

> Wherever there is not sufficient light, within the limits of the highway location, to make all vehicles, persons, or substantial objects clearly visible within said limits for a distance of at least 150 ft., the white lights which a motor vehicle is required to display by Section 7 of Chapter 534 of the Acts of 1909 shall, when said vehicle is in motion, throw sufficient light ahead to show any person, vehicle, or substantial object upon the roadway straight ahead of the motor vehicle for a distance of at least 150 ft. Any light thrown directly ahead or sidewise shall be so arranged that no dazzling rays from it or from any reflector shall be at any time more than 3½ ft. above the ground on a level road at a distance of 50 ft. or more ahead of said vehicle, and said light shall be sufficient to enable the operator of the motor vehicle to see any person, vehicle, or substantial object upon the roadway or side thereof, for 10 ft. on each side of the motor vehicle 10 ft. ahead of said vehicle.

The commission took the stand that a State regulation would prevent any cities or towns making rules that would puzzle automobilists. It also planned to word the regulations so that it would not be necessary to adopt any device unless the owner of a car wanted to do so.

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Annual Registration for D. C.?

WASHINGTON, D. C., Oct. 30—If the recommendations of Ben L. Price, tax collector, are adopted by Congress, Washington motorists will have to pay an annual registration fee instead of the perpetual license fee of $2 that is now exacted. In his annual report Price recommends that a license fee based on horsepower rating be charged and he suggests that the fees exacted by Maryland or Virginia be followed. If such a fee is charged it will take the place of the present personal tax fee that is charged in addition to a fee of $2 that must be paid to secure a license number, such number being good as long as the person who takes it out owns the car. If the car is sold at any time the license is void and a new one necessary.

15,485 Employees in N. Y. Plants

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Twenty-six Automobile and Parts Makers' Wages increased 10% in Sept.

NEW YORK CITY, Oct. 28—Evidence that the automobile and parts manufacturers in New York State have made a large increase in activity and an improvement in business, which has been manifest all summer, appears in returns received by the State Industrial Commission from representative manufacturers throughout the State. In its September returns it had reports in the automobile group for twenty-six firms with 15,485 employees in the State. All but five of these firms were engaged in the manufacture of automobiles or parts. All these five firms together had less than 1000 employees.

In July, 1915, 2.3 per cent more people were employed than in June; in August 1.5 per cent more than in June; and in September 14.4 per cent over June. Comparing returns for each month this year with the corresponding month last year a remarkable improvement since last year appears; June returns show 27.2 per cent more employees this year than last; July returns show 32.1 per cent more employees; the August returns 30 per cent more employees, and the September returns 47.4 more employees than last year.

A large increase in wages was made. Figures for that item show a progressive increase from June to September this year, 10 per cent more wages being paid in the middle week of September this year than in the middle week of June. For the middle week of each month this year as compared with last, in June 35.6 per cent; in July 33.1 per cent; in August 42.9 per cent; and September 46.5 per cent more wages were paid this year than last.

As indicating how the improvement in that industry compares with the improvement for manufacturing in general, the following figures show returns indicating 1 per cent fewer employees in July; 2 per cent fewer in August; but 4 per cent more for September of this year as compared with June of this year. In comparing this year with last there were 2.4 per cent fewer employees in June; in July 0.2 per cent more; in August 4.4 per cent more; and in September 5.4 per cent more employees this year than last.

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Western Tire Co. Now General Rubber Mfg. Co.

KANSAS CITY, Mo., Oct. 27—The Western Tire & Rubber Co., this city, is building a three-story factory at Akron, Ohio, where it will move its plant Dec. 1. The company has been re-incorporated under Ohio laws, under the name of the General Rubber Mfg. Co. and the capital has been increased to $200,000.

The company will continue to make the K. C. line of tire accessories. In addition to this, it is adding equipment to make 400 tires a day. The new plant will be in full operation by Jan. 1. The personnel of the company will remain unchanged.

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Crowther Builds Model Cars

ROCHESTER, N. Y., Oct. 29—The Crowther Motor Co., whose factory is located at Ridgway and Woodrow Avenues, is making progress in construction work as reported in THE AUTOMOBILE for Oct. 28. The model cars are under construction and will be exhibited at the winter shows. The cars are expected to sell at $550, this including electric starter, lights, demountable rims and speedometer. The line will include a roadster touring car and a 1200-lb. delivery wagon. In these the transmission system of Charles E. Duryea, pioneer automobile manufacturer, will be used, in which the drive is direct into the rims of the two rear wheels, thus eliminating gearset, clutch and differential, as well as the live type of rear axle. It is expected to have a production of fifty to sixty cars per day after April 1.

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Will Make Gas-Electric Truck

MILWAUKEE, WIS., Oct. 29—The National Brake & Electric Co., Milwaukee, Wis., is engaged in the development of a new heavy duty motor truck of the gas-electric type, said to be particularly adapted for use on the war front. The company is part of the Westinghouse group. No information relative to the new product will be given out until development work is completed. The National company manufactures compressors, gasoline locomotives, air brakes and electrical appliances and is the specialty plant of the Westinghouse company. Since July 1 the Milwaukee works force has been increased from 700 to 1000 men.

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Bosch Gets Nine Contracts

NEW YORK CITY, Nov. 1—The Bosch Magneto Co. has closed contracts with the following concerns to use Bosch magnetos for the coming season: Chandler Motor Car Co., Cleveland, Ohio; Crawford Automobile Co., Hagerstown, Md.; Continental Motor Mfg. Co., Detroit; Ohio Armleder Co., Cincinnati, Ohio; Palmer-Meyer Motor Car Co., St. Louis, Mo.; H. E. Wilcox Motor Co., Indianapolis, Ind.; U. S. Motor Truck Co., Cincinnati, Ohio; Hendrickson Motor Truck Co., Chicago, Ill.; Alamo Mfg. Co., Hillsdale, Mich.

Detailed Export Statistics for August and 8 Months Show Big Gains

United Kingdom Retains First Place with 2290 Cars Worth $3,530,831 in August—Increases in Shipments to West Indies, Asia, Oceania and Other Countries

WASHINGTON, D. C., Nov. 1—As indicated in a recent issue of THE AUTOMOBILE the exports of automobiles continue to grow so rapidly that even those in close touch with the industry are astonished. The gross figures for August and the eight months ended August, with figures for the corresponding periods of last year, have already been published.

The Department of Commerce to-day announced that September automobile exports were 2227 commercial vehicles, value, $5,882,255; pleasure cars, 4299, value, $3,215,459; parts, $1,613,419.

Detail figures show exports of commercial cars rose from sixty-six, valued at $124,016, in August, 1914, to 1614, valued at $4,387,193 in August last, while during the eight months' period they increased from 509, valued at $772,257, in 1914, to 15,042, valued at $41,886,961, in 1915. Exports of passenger cars likewise increased from 385, valued at $441,879, in August last year, to 3,839, valued at $3,121,834, in August last, and from 18,884, valued at $16,612,060, in 1914, to 26,736, valued at $23,576,188, in 1915.

United Kingdom Best Customer

Naturally, the United Kingdom retains first place in the volume of its imports of cars from this country, the figures showing that during August a year ago, twenty-seven machines, valued at $38,500 were exported to King George's domain, while during August last the number had increased to 2290 and the value to $3,530,831. During the eight months' period the number of cars exported increased from 4994, valued at $4,126,263, in 1914, to 16,784, valued at $25,528,943 in 1915.

There were no cars exported from this country to France in August, 1914, while in August last the number was 196 and the value $661,972. During the eight months' period the number rose from 1044, valued at $625,636, in 1914, to 4464, valued at $11,209,798 in 1915.

Germany failed to receive any cars from this country, and during the eight months' period the imports from this country fell from 1063 cars, valued at $799,552, in 1914, to four cars valued at $2,800, in 1915.

One car, valued at $1,000, was exported to Italy in August, 1914, while in August, 1915, the number had grown to thirteen and the value to $11,203. The eight months' period showed a decline from 229 cars, valued at $148,388, in 1914, to 121 cars, valued at $74,498, in 1915.

Other European Gains

Under the heading "Other European Countries," a big gain in exports is in-

Exports and Imports of Automobiles and Parts for August and Eight Preceding Months

	August				Eight months ending August			
	1914		1915		1914		1915	
	Number	Value	Number	Value	Number	Value	Number	Value
EXPORTS								
Commercial	66	$124,016	1,614	$4,387,193	509	$772,257	15,042	$41,886,961
Passenger	385	441,879	3,839	3,121,834	18,884	16,612,060	26,736	23,576,188
Total	451	$565,895	5,453	$7,509,027	19,393	$17,384,317	41,778	$65,463,149
EXPORTS BY COUNTRIES								
France	....	.....	196	$661,072	1,044	$625,636	4,464	$11,209,798
Germany	....	.....	....	.....	1,063	799,552	4	2,800
Italy	1	$1,000	13	11,203	229	148,388	121	74,498
United Kingdom	27	38,500	2,290	3,530,831	4,994	4,126,263	16,784	25,528,943
Other Europe	12	10,533	722	1,652,280	2,378	1,886,647	5,544	14,741,288
Canada	238	377,821	721	480,677	3,594	4,447,442	4,682	3,673,203
Mexico	6	4,400	8	9,100	60	70,374	69	65,406
West Indies and Bermuda	32	19,247	368	193,725	352	305,310	2,072	1,110,173
South America	19	13,288	274	149,319	891	722,527	1,486	793,037
British Oceania	79	60,562	391	322,689	2,666	2,294,033	2,760	2,368,736
Asia and other Oceania	14	19,404	330	393,771	1,193	1,129,405	2,508	4,703,181
Other countries	23	21,140	140	103,460	929	828,740	1,284	1,192,086
Parts of (not including engines and tires)	...	196,527	....	2,038,321	.....	4,107,545	.....	9,381,440
Total automobiles, etc.	....	$762,422	....	9,547,348	.....	21,491,862	.....	74,844,589
Tires								
For automobiles	....	$188,002	....	$1,211,804	.....	$2,290,094	.....	$5,509,787
Belgium	....	.....	....	.....	.....	301	.....	.....
Germany	....	.....	....	.....	.....	81,917	.....	.....
England	....	46,467	....	703,109	.....	936,260	.....	3,180,992
Canada	....	92,789	....	170,686	.....	742,553	.....	692,920
Mexico	....	9,684	....	5,936	.....	41,824	.....	71,387
Cuba	....	.....	....	22,028	.....	.....	.....	187,655
Australia	....	.....	....	91,124	.....	.....	.....	311,755
Philippine Islands	....	10,583	....	22,465	.....	77,689	.....	195,322
Other countries	....	28,479	....	196,456	.....	409,550	.....	869,756
IMPORTS								
	No. dutiable		No. dutiable		No. dutiable		No. dutiable	
Automobiles	20	$19,809	26	$28,912	124	$198,440	159	$248,738
IMPORTS BY COUNTRIES								
France	5	$3,008	6	$12,046	51	$91,717	45	$90,766
Germany	1	1,428	....	.....	10	16,556	.....	.....
Italy	8	9,086	....	.....	26	31,884	22	28,526
United Kingdom	2	2,517	....	.....	15	31,496	25	53,206
Other countries	4	3,770	20	16,866	22	26,787	67	76,240
Parts of (except tires) dut.	....	$31,222	.....	$35,776	.....	$634,051	.....	$423,573
SHIPMENTS TO NON-CONTIGUOUS TERRITORIES OF THE UNITED STATES								
Alaska								
Automobiles	6	$11,000	9	$9,444	51	$64,603	65	$77,137
Parts of (except engines and tires)	....	1,923	....	1,673	.....	7,324	.....	9,811
Hawaii								
Automobiles	20	30,667	145	146,011	545	572,306	682	741,331
Parts of (except engines and tires)	....	7,412	....	10,471	.....	64,027	.....	78,852
Porto Rico								
Automobiles	41	34,833	61	44,603	214	201,815	426	338,763
Parts of (except engines and tires)	....	5,950	....	1,611	.....	47,184	.....	66,057
Philippine Islands								
Automobiles	10	13,465	153	143,307	351	356,511	489	513,121
Parts of (except engines and tires)	....	847	....	4,184	.....	30,721	.....	33,161

dicated. In August a year ago the exports from this country amounted to twelve cars, valued at $10,533, while in August last the number was 722 and the value $1,652,280. The figures for the eight months' period were 2378 cars, valued at $1,886,647, in 1914, and 5544 cars, valued at $14,741,288, in 1915.

There were 238 cars, valued at $377,821, shipped to Canada in August a year ago, while in August last the number had increased to 721 and the value to $480,677 in August last. This increase, however, was not maintained during the eight months' period, the number of cars exported to our Northern neighbor in 1914 being 3594, valued at $4,447,442, while in 1915 the number was 4682 but the value was only $3,673,203.

War-ridden Mexico took eight cars, valued at $9100 from this country in August last, as against six cars, valued at $4,400 in August a year ago. During the eight months of this year the exports of cars to that country amounted to sixty-nine, valued at $65,406, while during the corresponding period of last year the number was sixty, and the value $70,374.

West Indies Buy More

The West Indies and Bermuda are beginning to appreciate American-built motor cars, the export figures showing an increase from thirty-two cars, valued at $19,247, in August, 1914, to 368 cars, valued at $193,725, in August last, and from 352 cars, valued at $305,310, in 1914, to 2072 cars, valued at $1,110,173, in 1915.

Increased exports to South American countries are also shown in the latest table of statistics. In August a year ago, nineteen cars, valued at $13,288, were shipped to various South American countries, while in August last, the number had increased to 274 and the value to $149,319. During the eight months' period the exports increased from 891 cars, valued at $722,527 in 1914, to 1486 cars, valued at $793,037, in 1915.

Increase for Oceania

British Oceania continues to be a good customer for American cars, the exports having increased from seventy-nine cars, valued at $60,562, in August, 1914, to 391 cars, valued at $322,689, in August last, while during the eight-month period the number of cars exported increased from 2666, valued at $2,294,033, in 1914, to 2760 cars, valued at $2,368,736 in 1915.

Fourteen cars, valued at $19,404, were exported to Asia and other Oceania in August a year ago, while in August last the number was 330 and the value $393,771. During the eight months' period the exports rose from 1193 cars, valued at $1,129,405, in 1914, to 2508 cars, valued at $4,703,181, in 1915.

S. A. E. Winter Meeting Program

Electrical Equipment of Cars To Receive Marked Attention on Jan. 5 and 6

NEW YORK CITY, Nov. 1—The 1916 Winter Meeting of the Society of Automobile Engineers will be held in the Engineering Societies Building, this city, Wednesday and Thursday, Jan. 5 and 6.

At the first session of the society meeting, to be held on Wednesday morning, business matters and reports of divisions of the standards committee will be submitted and discussed. For the sessions to be held on the morning and afternoon of the following day, Thursday, papers on current subjects of special significance are scheduled.

It is the purpose of the Council and the Meetings Committee that the coming meeting shall be shorter than the annual meetings of previous years, in order to afford the members an opportunity to concentrate their attendance on fewer sessions during the much occupied time of Show Week. It is believed that the papers to be presented will be of sufficient interest and merit to bring about a good attendance and valuable discussion.

A large portion of the meeting will be devoted to consideration of matters connected with the electrical equipment of gasoline cars.

Battery vs. Magneto Ignition

Comprehensive consideration will be given to the points involved in and the relative merits of magnetos and batteries as sources of ignition. Among those who will present statements in connection with this timely matter are Alexander Churchward; Frank Conrad; Dr. R. H. Cunningham, and E. Gassmann.

Electric Lighting and Starting

Joseph Bijur will present a paper entitled Electric Lighting and Starting for Automobiles, taking up among other topics the desirable characteristics and cranking speeds of starting motors.

Electric Bulbs

Henry Schroeder will present data on Electric Bulbs for Automobiles, indicating the various properties and efficiencies desired and to be expected. The paper should be of a great deal of benefit generally to automobile engineers engaged in the design and production of gasoline and electric vehicles, as well as in connection with the work of the Electrical Equipment Division.

Sulphur Content in Steel

Dr. J. S. Unger will read a paper on the Effect of Sulphur Content in Steel, giving the results of exhaustive tests. Discussion of this subject should result in the acquisition of fundamentally valuable information.

It is possible that a few more papers will be added to the program, but the principal idea of the committee is to have only subjects of unusual importance presented and that sufficient time shall be allowed for as thorough discussion of these as may be desired.

The annual dinner will be held at the Plaza Hotel on the evening of Thursday, Jan. 6. Tickets are $5 each.

Standards Committee Meeting

A meeting of the standards committee will be held at the rooms of the society in New York on Tuesday morning Jan. 4. All members of the society may attend this committee meeting.

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Detroit S. A. E. to Hear Diamond on Piston Design

DETROIT, MICH., Nov. 1—At the next meeting of the Detroit section of the Society of Automobile Engineers, to be held Nov. 12 in the convention hall of the Pontchartrain hotel, the feature will be a talk by J. E. Diamond of the Aluminum Castings Co. on the subject of Piston Design and Its Relation to the Cothias Process. Mr. Diamond's talk will cover piston design in general, as well as the aluminum alloy piston.

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Detroit Committee on S. A. E. Cruise

DETROIT, MICH., Nov. 1—Chairman George W. Dunham, of the Detroit Section of the Society of Automobile Engineers, has named W. A. Brush and Mason P. Rumney, to serve with him as the committee in charge of the next summer's annual cruise of the society. The committee is already at work.

Since the September list of contributors to the maintenance fund of the Detroit section of the society was published, two new concerns have been added to this list, the Electric Storage Battery Co. has pledged $100 and the Doehler Die Castings Co. $50. The total pledged to Oct. 15 being $2,850.

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Moline Plow to Continue Buggies

MOLINE, ILL., Nov. 3—The Moline Plow Co., whose entrance into the automobile field with a new passenger car was announced recently, wish it to be understood that in so doing they are not relinquishing the buggy business which will be continued as usual.

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Grant Adds an Acre

FINDLAY, OHIO, Nov. 1—The Grant Motor Co. is building three large additions to their North and South plants in this city. All are one-story and cover an acre of floorspace. The company is greatly hampered for space.

Gasoline Is Higher in West

Since March Average Increase Throughout Country Is 4 Cents per Gal.

NEW YORK CITY, Oct. 29—Gasoline prices continue to rise throughout the West, the latest advance being that in Cleveland where Standard Oil has raised its price per gallon 1½ cents to 14 cents to garages. The independents have met the increase by an advance of 1 cent a gallon to 14 cents. White Rose brand gasoline of the National Refining is now quoted at 16½ cents a gallon, an advance of 3 cents. The price of retail trade is 1 cent higher than these quotations. In March the garage price was 11 cents, and there was no change in price until Sept. 9.

The average increase throughout the country has been about 4 cents a gallon since March. In the past six weeks gasoline prices at the various cities have been advanced two or three times. This week there has been an increase in price from 1 to 3 cents a gallon in the principal cities of the country, including Portland, Los Angeles, Seattle, Minneapolis, San Francisco, Detroit, Kansas City, St. Louis, Chicago, Louisville, Denver and Cleveland. The oil experts attribute the advance to the increase in automobiles, the general increase in demand for gasoline and the fact that production has not been increased.

The Standard Oil Co. of Indiana last week, increased the price of gasoline in St. Louis 1 cent to 13 cents to automobile owners and 11.9 cents to tank owners. This follows the advance in Chicago of 1 cent to 12½ cents and 11½ cents respectively.

St. Louis jobbers estimate that the fight between the Standard Oil Co. of Indiana and the independents which commenced last May has netted the Standard Oil nearly $90,000,000. About half of this represents the increase in the price of crude oil, of which the company bought nearly 67,000,000 barrels, which oil is still in the company's tanks. The other half has been made by buying all gasoline from the independent refiners in the Cushing oil field.

Gasoline prices in Cincinnati have been advanced 3 cents a gallon to 15 cents, and further advance is looked for. This price is for tank wagons. To wholesalers the price is 14 cents, although on contracts to wholesalers deliveries are being made at lower prices. The price in March for tank wagons was 12 cents and the wholesale price was 11 cents.

The Continental Oil Co. and the Midwest Refining Co. in Denver have advanced the price 1 cent to 17 cents a gallon to tank wagons and 16 cents to garages.

Louisville gasoline now quotes at 13½ cents a gallon on tank wagons, compared with 11 cents at the end of last March.

The accompanying table gives the current price in cents per gallon on a tank wagon or garage basis in the larger cities in the United States. This is compared with the price on March 31 and the advance in cents per gallon. This price is several cents below what the consumer has to pay for his gasoline, that depending on the quality of the fuel, etc.:

	Current Price, Cents	March 31 Price, Cents	Advance, Cents
Atlanta	18	12.5	5.5
Baltimore	15	11	4
Boston	18	13	5
Charleston, S. C.	18	15	3
Cheyenne, Wyo.	16	15	1
Chicago	12.5	10.5	2
Cincinnati	15	12	3
Cleveland	14	11	3
Dallas	17	10	7
Denver	17	15	2
Detroit	13	10.5	2.5
Douglas, Ariz.	18	16	2
El Paso	18	11	7
Fort Worth, Tex.	17	10	7
Hartford	17	11	6
Houston	17	10	7
Kansas City	11.8	9.8	2
Louisville	13.5	11	2.5
Los Angeles	14	12	2
Memphis	16	10	6
Minneapolis	13.5	11.5	2
New York City	17	12	5
Newark	16	9	7
New Orleans	15	11	4
Norfolk	16	12	4
Oklahoma City	17	12	5
Pensacola	15	15	0
Philadelphia	14	11	3
Portland, Me.	18	13	5
Portland, Ore.	14	12	2
St. Louis	11.9	9.9	2
St. Paul	12.5	11.5	1
San Francisco	13.5	11.5	2
Santa Fe	20	17	3
Savannah	17	13	4
Seattle	14	12	2
Shreveport	15	10	5
Tucson, Ariz.	18.5	17	1.5
Vicksburg	15	13	2

Metal Prices Higher

NEW YORK CITY, Nov. 1—Market quotations last week were higher, especially in the metals. With the exception of antimony, all the metals showed substantial gains, with open-hearth steel the feature. This rose $2.00 per ton, closing on Saturday at $26.00. Bessemer steel closed on Saturday at $25.00 per ton; or 50 cents higher than the opening on Tuesday. Both electrolytic and Lake coppers rose ¼ cent a lb., both closing at 18. Lead saw a gradual rise throughout the week and closed at $4.90 or a gain of 15 cents per 100 lb. Tin fluctuated throughout the week, its highest mark being $34.75 and its lowest $33.75, quoted on Tuesday. It closed on Saturday at $34.75 at a gain of $1.00 per 100 lb.

In the oils and lubricants markets, two noticeable changes occurred, fish oil, Menhaden, rose to 45 cents at a gain of 3, and Pennsylvania petroleum rose 5 cents a barrel, closing at $1.80.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum	.53	.53	.53	.54	.54	...	+.01
Antimony	.34	.34	.34	.34	.34	...	...
Beams and Channels, 100 lb.	1.62	1.62	1.67	1.67	1.67	...	+.05
Bessemer Steel, ton	24.50	24.50	25.00	25.00	25.00	...	+.50
Copper, Elec., lb.	.17¾	.17¾	.17¾	.18	.18	...	+.00¼
Copper, Lake, lb.	.17¾	.17¾	.17¾	.18	.18	...	+.00¼
Cottonseed Oil, bbl.	7.78	7.80	7.73	7.75	7.78	...	...
Cyanide Potash, lb.	.23	.23	.23	.23	.23	...	...
Fish Oil, Menhaden, Brown	.42	.42	.42	.45	.45	...	+.03
Gasoline, Auto, bbl.	.17	.17	.17	.17	.17	...	...
Lard Oil, prime	.85	.85	.85	.85	.85	...	...
Lead, 100 lbs.	4.75	4.75	4.75	4.90	4.90	...	+.15
Linseed Oil	.62	.62	.62	.62	.62	...	...
Open-Hearth Steel, ton	24.00	25.00	26.00	26.00	26.00	...	+2.00
Petroleum, bbl., Kans., crude	.80	.80	.80	.80	.80	...	...
Petroleum, bbl., Pa., crude	1.75	...	1.80	1.80	1.80	...	+.05
Rapeseed Oil, refined	.77	.77	.77	.77	.77	...	...
Rubber, Fine Up-River, Para	.57	.57	.57	.57	.57	...	...
Silk, raw, Ital.	4.30	...	...	4.30	...	...	...
Silk, raw, Japan	4.10	...	...	4.10	...	...	...
Sulphuric Acid, 60 Baume	1.00	1.00	1.00	1.00	1.00	...	...
Tin, 100 lb.	33.75	34.75	34.25	34.75	34.75	...	+1.00
Tire Scrap	.04¾	.04¾	.04¾	.04¾	.04¾	...	...

Federal Trade Commission to Investigate Gasoline Prices

WASHINGTON, D. C., Oct. 30—Request has been made of the federal trade commission to institute an investigation of charges that illegal practices prevail in the marketing of gasoline. Price fluctuations have been brought to the attention of the commission, which, it is declared, are not explained by the difference in freight rates between the cities where the varying prices exist. A thorough investigation of the matter is to be made by the commission.

Tire Sales Large—Manufacturers Increase Production

NEW YORK CITY, Oct. 29—Tire companies in this country are doing a large business. Heavy home sales of automobiles and the war's demands have brought about this prosperity. About 14,000 tires a day are being turned out by the B. F. Goodrich Co.; Goodyear is turning out about 10,000 and the U. S. Rubber is now making 8000 and this amount will shortly be increased to 10,000. The Kelly-Springfield company will be producing 1500 a day by Dec. 1. The company has purchased a new plant at Wooster to take care of its production.

At Akron operations are continued on a 24-hr. schedule and the company is so far behind its orders that capacity operations are certain on the same 24-hr. schedule throughout the remainder of the year.

It is said that the increase in the cost of fabric and crude rubber will possibly decrease the net earnings of the tire makers in the closing half of 1915, as compared with the first half. Fabric is now selling approximately 25 per cent above the price prevailing early in the year. Crude rubber is close to 10 per cent higher.

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Hess-Bright Issues Licenses

PHILADELPHIA, PA., Oct. 29—The Hess-Bright Mfg. Co., this city, has issued licenses covering the manufacture of ball bearings after the Conrad patent, to the Standard Roller Bearing Co., Philadelphia, Pa.; the New Departure Mfg. Co., Bristol, Conn.; the Gurney Ball Bearing Co., Jamestown, N. Y.; and the U. S. Ball Bearing Co., Chicago, Ill.

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Penberthy Gets Carbureter Rights

DETROIT, MICH., Nov. 1—The Penberthy Injector Co. has secured the right for the Ball & Ball carbureter in U. S. and Canada and is now manufacturing the device. F. H. Ball and his son F. O. Ball, formerly connected with the Ball Engine Co., Erie, Pa., have been retained as engineers.

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Dividends Declared

B. F. Goodrich Co., Akron, Ohio, regular quarterly of 1¾ on preferred, payable Jan. 1 to stock of record Dec. 21.

Tire Issues Feature Market

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Firestone Reaches 790 Mark—Kelly-Springfield Closes at 300 with 53 Point Gain

NEW YORK CITY, Nov. 1—The drop in Studebaker and the record rise in Firestone and Kelly-Springfield Tire common featured last week's security markets. A rally occurred at the close on Friday after a sharp decline, the crisis in the French cabinet occurring opportunely with a general strengthening of the market. There was heavy liquidation during the earlier hours on Friday, the rally setting in late in the afternoon. At one time the drop in Studebaker reached a total of 21½ points, striking terror in those who have been following the advance. However, the stock picked up and closed on Saturday at 172, just 16 points under last week's mark. Firestone common kept up its record rise and reached on Saturday the high mark of 790 with a 70-point rise for the week. Kelly-Springfield common reached the 300-point mark at the close on Saturday, a gain of 30 points for the week.

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General Motors Strong

General Motors was the strongest feature on Saturday, advancing 34½ points during the day to 390 on the probability of early inauguration of regular dividend payments. The week's rise was 20 points.

Paige-Detroit went up 20 points, closing at 460. Chevrolet closed at 130, a 5-point gain. Maxwell stocks showed substantial gains, the common rising 8¾ points, the first preferred 3¾ and the second preferred 7½.

The 550-point rise of Canadian Ford featured the inactive stocks in the Detroit Stock Exchange. This stock last week dropped 50 points. In the active Detroit stocks, the 25-point rise in Paige-Detroit common and the 20½ point drop in Studebaker common were the features. General Motors common dropped to 350, a loss of 16 points.

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Maxwell Meeting Postponed Until Nov. 10

NEW YORK CITY, Nov. 1—A special meeting of the holders of the stock trust certificates of the Maxwell Motor Co. has been postponed until Nov. 10. The meeting was called to ratify the plan recently submitted by the directors for the retirement of the accumulated 14¼ per cent back dividends on the first preferred stock by the issue of non-interest-paying warrants convertible into first preferred stock at par and to authorize the issue of $1,050,000 additional stock of the same class.

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Van Blerck Motor to Expand

MONROE, MICH., Nov. 1—Fifty per cent of the capital stock of the Van Blerck Motor Co., this city, has been secured by Eastern capital, and $150,000 additional stock will be issued. New land will be purchased, it is announced, and the factory enlarged to three times its present size. The present officers will remain until a reorganization is effected.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ge
Ajax-Grieb Rubber Co., com			300	..	..
Ajax-Grieb Rubber Co., pfd			101	..	..
Aluminum Castings, pfd			102	..	..
J. I. Case, preferred			83	85	+4
Chalmers Motor Company, com			150	160	—5
Chalmers Motor Company, pfd			102	104	..
Chevrolet Motor Co			130	133	+5
Electric Storage Battery Co			71	73	..
Goodyear Tire & Rubber Co., com			790	810	+70
Firestone Tire & Rubber Co., pfd			112	..	..
General Motors Company, com			392	396	+20
General Motors Company, pfd			113	114	+1
B. F. Goodrich Company, com			76	77¼	—1½
B. F. Goodrich Company, pfd			113½	115½	+3½
Goodyear Tire & Rubber Co., com			334	340	+2
Goodyear Tire & Rubber Co., pfd			110	112	..
Gray & Davis, Inc., pfd			..	..	..
International Motor Co., com			39	41	—7½
International Motor Co., pfd			65	70	—3
Kelly-Springfield Tire, com			300	302	—53
Kelly-Springfield Tire, 1st pfd			95	96	—3½
Kelly-Springfield Tire, 2nd pfd			..	..	..
Maxwell Motor Company, com			82¾	83¾	+8¾
Maxwell Motor Company, 1st pfd			100¾	101¾	+3¾
Maxwell Motor Company, 2nd pfd			63½	64⅝	+7½
Miller Rubber Company, com			240	250	+5
Miller Rubber Company, pfd			109	110	..
New Departure Mfg. Co., com			..	..	..
New Departure Mfg. Co., pfd			..	..	..
Packard Motor Car Company, com			130	140	—5
Packard Motor Car Company, pfd			100	103	..
Paige Detroit Motor Car			460	..	+20
Peerless Motor Car Co., com			122	130	..
Peerless Motor Car Co., pfd			92	94	..
Portage Rubber Co., com			59½	60	+4½
Portage Rubber Co., pfd			94	95	+½
Regal Motor Co., pfd			14	20	+1
*Reo Motor Truck Company			19¼	20¾	—¼
*Reo Motor Car Company			38½	40	..
Splitdorf Electric Co., pfd			..	..	..
Stewart-Warner Speed. Corp., com			74½	75½	..
Stewart-Warner Speed. Corp., pfd			106	..	..
Studebaker Corporation, com			172	173¾	—16
Studebaker Corporation, pfd			115	117	+4
Swinehart Tire & Rubber Co			91	93	+1
Texas Company			170	171	+8
U. S. Rubber Co., com			55½	56¾	+1¾
U. S. Rubber Company, 1st pfd			105½	106¾	—½
Vacuum Oil Company			215	225	..
White Company, preferred			110	..	..
Willys-Overland Co., com			260	264	+2
Willys-Overland Co., pfd			109	110½	+1

No quotations available at this time on account of war.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ge
Chalmers Motor Co., com	..	97	..	160	—5
Chalmers Motor Co., pfd	..	94½	101	104	+1
†Continental Motor Co., com	155	180	200	250	..
Continental Motor Co., pfd	..	75	88	94	—2
General Motors Co., com	..	62½	350	374	—16
General Motors Co., pfd	..	82	112	114	..
Maxwell Motor Co., com	10½	11¼	83½	86½	+12
Maxwell Motor Co., 1st pfd	33	35¼	99½	102	+ 2¾
Maxwell Motor Co., 2nd pfd	14	16½	63½	66½	+10
Packard Motor Car Co., com	..	101	129	134	—5
Packard Motor Car Co., pfd	90	..	100	101¼	..
Paige-Detroit Motor Car Co	..	..	465	..	+25
*Reo Motor Car Co	21	..	39¼	40¼	+¾
*Reo Motor Truck Co	10½	11¼	20⅛	..	+¼
Studebaker Corp., com	..	..	170	174	—20½
Studebaker Corp., pfd	..	..	109	112	..

INACTIVE STOCKS

*Atlas Drop Forge Co	..	25	..	29	..
Ford Motor Co. of Canada	..	500	2,000	..	+550
Kelsey Wheel Co	185	..	215	..	+10
*W. K. Prudden Co	18½	20	22	24	..
Regal Motor Car Co., pfd	..	30	..	..	..

*Par value $10.

†The quotation 200-250 for the Continental stock is for the new stock issued after a 100 per cent stock dividend had been paid. There is in reality a net change or increase of 80 points from the former quotation.

200,000 See Cars at Dallas Show

$1,000,000 Worth of Cars Displayed by 30 Exhibiting Dealers

DALLAS, TEX., Oct. 25—With $1,000,000 worth of automobiles on display, the third annual automobile show by the Dallas Automobile Dealers' Association is on. It opened with the Texas State Fair, Oct. 16, and will be concluded Sunday, Oct. 31. The show is significant for several reasons, first that this is the second showing of 1916 models in the United States, the first having been at Milwaukee; second, for the reason that during the first nine days of the show, more than 200,000 visitors, many of them farmers interested in the use of automobiles, passed through the automobile exhibit building. Of this great mass of visitors at least 50,000 stopped and asked questions regarding the merits of the various cars.

There were thirty exhibitors in the automobile exhibit building and every foot of space was occupied. Had the building been larger, the space could have been profitably used, as the Wichita Motor Co. and several others were compelled to seek space in adjacent buildings. The automobile building was erected three years ago. It cost $17,500 and is 149 by 264 ft., built of wood and concrete with concrete floors, large plate glass windows and several skylights.

Plans are to be made for an addition to the building before the next automobile show. The present affair cost the local dealers approximately $30,000. Of this expense, each dealer bore his share. No admission fee was charged this year, believing that without such there would be more visitors to the building.

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173 More Accessory Exhibitors for Chicago and New York

NEW YORK CITY, Oct. 27—One hundred and seventy-three additional accessory exhibitors have been granted space at the New York City and Chicago automobile shows, Dec. 31-Jan. 8 and Jan. 22-29. One hundred and three of these are in New York and seventy-four in Chicago. This makes the total list of accessory exhibitors for New York 196 and for Chicago 153.

Additional Accessory Exhibitors

Able Engine Co., Inc.....New York City
Ahlberg Bearing Co.....Chicago, Ill.
American Die & Tool Co.....Reading, Pa.
American Express Co.....New York City
American Taximeter Co.....New York City
Apex Elec. Mfg. Co.....Chicago, Ill
Armstrong Cork Co.....Pittsburgh, Pa.
Asch & Co.....New York City
Atlas Spec. Mfg. Co.....Chicago, Ill.
Auto Gear & Parts Co.....New York City
B. & L. Auto Lamp Co.....New York City
Bausch Machine Tool Co...Springfield, Mass.
Benjamin Elec. Mfg. Co.....Chicago, Ill.
Eug. Bournonville Weld'g Co.New York City
Buchanan Elec. Steel Co....Buchanan, Mich.
Celfor Tool Co.....Buchanan, Mich.
Chilton Co.....Philadelphia, Pa.
Class Journal Co.....New York City
Cochran Pipe Wrench Mfg. Co..Chicago, Ill.
Comfort Shock Absorber Co.Hempstead, L. I.
Curtis Pneumatic Mchy. Co...St. Louis, Mo.
Cutting-Armstrong & Smith Sales Co., Detroit, Mich.
Daly & Co.....Detroit, Mich.
Dann Spring Insert Co.....Chicago, Ill.
P. Dempsey .....New York City
Dunham Piston Ring Co.....New York City
E. Edelmann & Co.....Chicago, Ill.
Edison Storage Battery Co..W. Orange, N. J.
Electric Automatic Cigar Lighter Co., New York City
Essex Rubber Co.....Trenton, N. J.
Evans Engine Co., Inc.....New York City
Ever Tight Piston Ring Co....St. Louis, Mo.
J. H. Faw, Inc.....New York City
Fitzgerald Mfg. Co.....Torrington, Conn.
C. H. Foster Accessories Co.....Chicago, Ill.
Peter A. Frasse & Co., Inc..New York City
Fryer-Anster Co.....Providence, R. I.
Gates Mfg. Co.....Indianapolis, Ind.
Gordon Tire & Rubber Co.....Canton, Ohio
Emil Grossman Mfg. Co., Inc., Brooklyn, N. Y.
Guide Motor Lamp Mfg. Co..Cleveland, Ohio
Hess Spring & Axle Co.....Carthage, Ohio
Hill Mfg. Co.....New York City
Hill Pump Valve Co.....Chicago, Ill.
Holt-Welles Co., Inc.....New York City
Horseless Age Co.....New York City
Houpert Machine Co.....New York City
Humboldt Mach. & Stamping Co., Long Island City, N. Y.
Interstate Electric Co.....New Orleans, La.
K. T. Lever Spring Co., Inc..New York City
Kales-Haskel Co.....Detroit, Mich.
Kemco Elec. Mfg. Co.....Cleveland, Ohio
Laidlaw Co., Inc.....New York City
Lane Bros. & Co.....Poughkeepsie, N. Y.
L. Lawrence & Co.....Newark, N. J.
Leece-Neville Co.....Cleveland, Ohio
S. Leschziner.....Newark, N. J.
Lincoln Electric Co.....Cleveland, Ohio
Lipman Air Appliance Co.....Beloit, Wis.
McQuay-Norris Mfg. Co.....St. Louis, Mo.
Manzel Bros. Co.....Buffalo, N. Y.
S. W. Merritt Co.....New York City
Metal Specialties Mfg. Co...New York City
Metal Stamping Co..Long Island City, N. Y.
Charles E. Miller.....New York City
Morrison-Ricker Mfg. Co.....Grinnell, Iowa
Morse Chain Co.....Ithaca, N. Y.
Motor Magazine.....New York City
Motor Veh. Pub. Co.....New York City
L. J. Mutty Co.....Boston, Mass
A. Nelson Mfg. Co.....Chicago, Ill.
New Era Spring & Spec. Co...Detroit, Mich.
Newmastic Co.....New York City
N. Y. Coil Co.....New York City
Paul G. Niehoff & Co.....Chicago, Ill.
O'Bannon Corporation.....New York City
Peerless Motor Spec. Co., Inc.New York City
Perkins-Campbell Co.....Cincinnati, Ohio
Phila. Storage Battery Co..Philadelphia, Pa.
A. J. Picard & Co.....New York City
Pierce Speed Controller Co....Anderson, Ind.
Pittsburg Electric Spec. Co...New York City
Wm. E. Pratt Mfg. Co.....Chicago, Ill.
Prest-O-Lite Co.....Boston, Mass.
Pyrene Mfg. Co.....New York City
P. Rielly & Son.....Newark, N. J.
Rutherford Rubber Co.....Rutherford, N. J.
Sharp Spark Plug Co.....Cleveland, Ohio
Silvex Co. .....New York City
Spitler Puncture Plug Co., Inc., New York City
Standard Roller Bearing Co., Philadelphia, Pa.
Standard Woven Fabric Co., Framingham, Mass.
John P. Stanley Co., Inc.....New York City
Stevens & Co.....New York City
F. W. Stewart.....Chicago, Ill.
Story & Reed, Inc.....New York City
Sunderman Safety Carburetor Corp., Newburgh, N. Y.
Superior Lamp Mfg. Co.....New York City
Chas. O. Tingley & Co.....Rahway, N. J.
Tobey Furniture Co.....Chicago, Ill
Triple Action Spring Co.....New York City
Triple Action Spring Co.....Chicago, Ill.
Turner Brass Works.....Sycamore, Ill.
Tuthill Spring Co.....Chicago, Ill.
U. S. Air Compressor Co.....Cleveland, Ohio
U. S. Gauge Co.....New York City
Universal Rim Co.....Chicago, Ill.
Universal Shock Eliminator Co., New York City
Van Cleef Bros.....Chicago, Ill.
Victor Auto Parts Co.....Cincinnati, Ohio
Warm Hand Steering Wheel Corp., Poughkeepsie, N. Y.
Wasson Piston Ring Co.....Hoboken, N. J.
Weaver Mfg. Co.....Springfield, Ill.
Webber Mfg. Co.....Boston, Mass.
West Steel Casting Co.....Cleveland, Ohio
Western Tire & Rubber Co..Kansas City, Mo.
Whalen Engineering Co.....New York City
White & Bagley Co.....New York City
C. A. Willey Co.....Long Island City, N. Y.
Wood Mfg. Co.....Fairfield, Conn.

Ohio Garagemen Organize

85 Discuss Business Problems at Session—Many Papers Read

COLUMBUS, OHIO, Nov. 1—Garagemen of the State of Ohio organized the Garage Owners' Association of Ohio, at the organization meeting held here Oct. 26 and 27. All told, some eighty-five garage owners and dealers attended the meeting.

In addition to welding themselves together into a powerful working unit, the garagemen also placed themselves on record as favoring the passage of the Stevens Bill, which would permit price maintenance; they also urged, through resolutions, that the National Automobile Chamber of Commerce take up again the question of setting a uniform time for the anouncement of new car models.

The Columbus organization was assisted in the formation of the State association by E. J. McGuirk, organizer for the Associated Garages of America, who gave the benefit of his experience. Aiding him were J. C. Thorpe, president of the Champaign County Automobile Trade Association, of Urbana, Ill.; L. C. Steers, secretary of the Garage Owners' Association of Michigan, and Jud S. Joslyn, of the Motor Car Dealers' Association of Rockford, Ill.

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Buick To Build Foundry

FLINT, MICH., Oct. 30—The Buick Motor Co. has arranged for the construction of a new two-story foundry, 530 by 300 ft. to be made of concrete and steel. It will be one of the largest and best equipped foundry buildings in the world and is expected to have an output capacity of at least 200 tons of castings a day. Several hundred men will be added to the working force when the plant is completed, which is expected to be about May 1, 1916.

The old foundry may be taken over by the Weston-Mott Co.

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New Plant for Detroit Battery

DETROIT, MICH., Oct. 30—The Detroit Battery Co. now located at 607 Fort Street, West, will have a three-story plant at 104 High Street. Ground will be broken in a few days and the factory is to be ready for occupancy by Jan. 1. The structure will be 70 by 100 ft. About 150 men will be employed.

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L. P. C. Men Find Work

RACINE, WIS., Oct. 29—All of the 280 mechanics employed by the L. P. C. Motor Co., Racine, Wis., which recently made an assignment in favor of credi-

tors, have received their wages in full and obtained immediate employment in similar industries in Racine, Kenosha and neighboring cities where the demand for skilled help cannot be filled. Fifty of the best men went into the Thos. B. Jeffery Co. plant at Kenosha on the day following the cessation of operations in the L. P. C. works. It is stated on good authority that creditors are trying to arrange matters so that the plant and its valuable equipment will be kept intact and the manufacture of motor cars resumed at an early date. F. Lee Norton of Racine is in charge as assignee.

17,255 Cadillac Eights in Year

DETROIT, Oct. 30—Since the Cadillac Motor Car Co. shipped its first eight-cylinder, Oct. 10, 1914, the company has built and shipped 18,159 cars to Oct. 23, 1915. During the year, starting from the day the first eight was shipped to Oct. 9 of this year, the number shipped was 17,255. The re-equipment of the plant with new machinery, new tools, took much more time than had been anticipated and therefore production was greatly hampered during several months.

Carriage Factories, Ltd., Forms Canadian Briscoe Co.

MONTREAL, QUE., Oct. 30—Carriage Factories, Ltd., of Canada, has formed the Canadian Briscoe Co. as a subsidiary. The latter will assemble the parts in Canada from the American Briscoe company, the cars of which will be sold through the Carriage Factories company.

This company has acquired the carriage manufacturing end of the McLaughlin Motor Car Co.

Studebaker Adds 52,500 Sq. Ft.

DETROIT, MICH., Oct. 30—A three-story building, 50 by 350 ft. for tuning cars before they are shipped, will be erected by the Studebaker Corp., adjacent to its plant No. 3. It will cost about $75,000. Other new structures are planned. Several now in course of construction will soon be ready for occupancy. The corporation reports that several hundred dollars were paid as premium to advance delivery of the structural steel material.

Chalmers Workers Form Clubs

DETROIT, MICH., Oct. 29—After hearing Hugh Chalmers, president of the Chalmers Motor Co. talk to them about looking ahead to the future and what could be done in this respect by getting together, by organizing, the office and shop workers of the Chalmers Motor Co. organized two clubs, Young Men Chalmers Club and Young Women Chalmers Club, both of which will be directed or run by the office and shop workers.

Apperson to Add 12 Acres

Floorspace Will Total 1,000,000 Sq. Ft.—Production to Be 10,000 Cars

KOKOMO, IND., Oct. 29—The Apperson Bros. Automobile Co., this city, will add floorspace totaling 500,000 sq. ft. or approximately 12 acres. The production is to be 10,000 cars. This additional floorspace will increase the total number of square feet to a million.

Work is already under way on two new buildings, which are being constructed at location of plant No. 2. These buildings will afford an additional space of 150,000 sq. ft., and will cost $75,000. The company is laying plans for an expenditure of $200,000 in new equipment.

Springfield Body May Move

SPRINGFIELD, MASS., Nov. 1—Without giving their employers an opportunity to arbitrate, 350 employees of the Springfield Metal Body Co. went out on strike, demanding an 8-hr. day and recognition of the Union. For some time the removal of the plant to Detroit has been contemplated in view of the fact that a large part of the company's business is now with Detroit car manufacturers. Unless the strikers return to work, it will be necessary to remove the machinery at once so that the company can fill orders for quick delivery.

$1,000,000 Building for Touraine

PHILADELPHIA, PA., Oct. 31—Plans have been completed and the work of construction will begin immediately on a building which has been leased to the Touraine Motor Co.

The lease taken by the Touraine company is for a period of twenty years and the total rental will be $1,600,000.

The building will be six stories high, with a basement, of steel and reinforced concrete, with exterior walls of white glazed terra cotta and white brick, and with the ground, representing a total expenditure of $1,000,000. It will have a frontage of 400 ft. on Market Street, 250 ft. on Twenty-third Street, 400 ft. along the Pennsylvania Railroad and 155 ft. along the Baltimore & Ohio Railroad. Each floor will have 70,000 sq. ft. of space and there will be four elevators, each 22 by 10 ft.

Edwards Carbureter Tested on Buick Six

CHICAGO, ILL., Oct. 28—The Edward's carbureter was introduced to Chicago to-day by an economy, speed and acceleration test conducted by the Technical Committee of the Chicago Automobile Club under sanction of the American Automobile Association. An economy of 28.9 miles per gallon and a speed of 58 m.p.h. with the same carbureter setting was obtained on a Buick small six.

The economy run was made over Chicago's boulevard system with a route arranged so that the car went approximately an equal distance in all four directions. A measured gallon of Red Crown gasoline having a gravity of 59.1 deg. Baumé at 60 deg. Fahr. was poured into a special tank, and the run made at a speed of 20 m.p.h. until the fuel was exhausted at 28.9 miles.

In acceleration tests, the car was put from a standstill to 25 m.p.h. through the gears in 11 and 1-5 sec. On high gear, it accelerated from 5 to 25 m.p.h. in 11 and 4-5 sec.

The National Carbureter Co., manufacturer of the carbureter, made the test. The instrument was designed by W. A. Edwards, formerly connected with Rayfield and Stromberg factories.

Willard Opens Two Branches and Ten Service Stations

CLEVELAND, OHIO, Oct. 29—The Willard Storage Battery Co., this city, has opened branches in San Francisco, Cal. and Atlanta, Ga. The San Francisco branch at 1433 Bush Street, 15,000 sq. ft. of floorspace. The Atlanta quarters are located at 8-10 East Cain Street.

Ten new service stations have recently been established bringing the total to 544. The ten new stations are as follows: Wayne Electric Co., Wooster, Ohio; Citizens Garage, Laredo, Tex.; Continental Auto Parts Co., Franklin, Ind.; Shepard Garage, Jerseyville, Ill.; William L. Clark, Seymour, Ind.; J. E. Rogers, Ft. Morgan, Col.; Hartman Bros., Montrose, Cal.; Albany Storage Battery Co., Inc., Albany, N. Y.; F. A. Harrison, Ridgewood, N. J., and Battery & Elec. Serv. Station, Mason City, Ia.

Wilson Sells Studebaker Agency

PHILADELPHIA, PA., Oct. 30—O. S. Wilson, for the past two years Philadelphia agent for the Studebaker car, has sold out his interests to a new concern, taking effect Nov. 1. Mr. Wilson had been a Studebaker man for a number of years.

Simms Magneto Enlarges

EAST ORANGE, N. J., Oct. 30—The Simms Magneto Co., this city, will build two additions to its plant, one to cost $10,000 and the other $5,000. Work will be started in the near future.

Aluminum Goods Adds Again

MANITOWOC, WIS., Nov. 1—The Aluminum Goods Mfg. Co., Manitowoc, Wis., which made important improvements and additions to its plant some time ago, has broken ground for another large factory addition and when this is completed

will undertake the erection of a new warehouse and shipping room. The factory addition will be five stories high, 53 ft., 6 in. by 300 ft., of brick and steel with mill floors. The investment in the addition will be approximately $100,000.

—

To Sell Morgan-Marshall Plant

EAST LIVERPOOL, OHIO, Oct. 29—The manufacturing plant, together with all of the equipment of the Morgan-Marshall Co-operative Rubber Tire Co., in this city, will be offered at public sale by Sheriff Crawford at an early date. It has been appraised at $60,000, and will be sold on the premises.

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Lima Crucible Steel Expands

LIMA, OHIO, Nov. 1—The Crucible Steel Co. of Lima will increase its capital from $50,000 to $100,000 and a new $30,000 addition will be built to the local plant at once. Seventy men will be added to the working force. The company turns out steed castings and parts for automobiles.

—

Overland to Increase Force

TOLEDO, OHIO, Oct. 29—Ten thousand additional men are to be employed by the Willys-Overland Co., just as soon as new additions now under construction, and others to be started at once are ready for occupancy. The output of automobiles is to be increased 1000 a week.

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Mitchell-Lewis Takes Inventory

RACINE, WIS., Oct. 29—The Mitchell-Lewis Motor Co., Racine, Wis., is taking inventory this and next week (Nov. 1 to 13) and in order to keep production at the highest level possible, only part of the departments are closed down at one time.

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A. Elliott Ranney Adds Daniels 8

NEW YORK CITY, Oct. 30—The Daniels eight will be handled in New York City by the A. Elliott Ranney Co., Fifty-second Street and Broadway.

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Randall Opens Advertising Agency

DETROIT, MICH., Nov. 1—Fred M. Randall has resigned from The Taylor-Critchfield-Clague Advertising Agency, and has started his own agency, the Fred M. Randall Co., with headquarters at 605 Ford Building, this city.

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Strike in Kundtz Body Plant

CLEVELAND, OHIO, Nov. 1—A strike by 3000 employees of the big woodworking plant of Theodore Kundtz, maker of automobile bodies and parts is said to endanger thousands of dollars' worth of orders for war trucks in Cleveland automobile factories.

Labor leaders declare the Kundtz plant makes bodies for practically every big automobile factory in Cleveland operating largely on war orders.

New Studebaker Policy

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Will Hold Conferences of Branch Mgrs. and Dealers Where Branches Are

DETROIT, MICH., Oct. 28—The Studebaker Corp. has inaugurated a new policy with regard to branch managers and dealers getting together with the factory officials for general conference or convention purpose. Heretofore the dealers and branch managers came to the administration offices in South Bend, Ind., to confer with the officials. Much good resulted, but, at the same time, it was not realized sufficiently that the time thus spent by the dealer away from his place of business was possibly causing him a loss, as very often these meetings were held at the busiest time of the dealer's season.

Now the officials of the Studebaker Corp. have decided to try the other way and instead of having the dealers and branch managers come to them they are going to them. There will be conferences of the men in the cities where Studebaker has branches and where it will be easier to get the men of the district or territory together.

The first of these conference meetings was held in Chicago this week, when about fifty Studebaker dealers from Illinois, Wisconsin and Indiana met and discussed matters concerning advertising campaigns, selling methods, production and other matters of interest to them.

The officials of the corporation who attended the meeting included A. R. Erskine, president; L. J. Ollier and James G. Heaslet, vice-presidents; Henry T. Meyers, manager of the commercial car department. Others who traveled with the Studebaker party were: J. E. Grady, sales manager for Canada; R. H. Williams, manager of the Detroit branch; H. V. Blevins, distributor for the State of Ohio; L. Davis, of the Cleveland district headquarters; F. H. Peck, dealer in Grand Rapids, Mich.; H. A. Biggs, of the Frank Seaman, Inc., advertising agency.

The party is making the trip in a special Pullman and will stop for conference purposes in Minneapolis, Omaha, Kansas City, St. Louis. The branch manager and dealer in each city visited will be taken along to the next stopping place.

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Randolph Builds Trailers

JONESVILLE, MICH., Oct. 28—The Randolph trailer is made by H. C. Randolph, successor to the Standard Auto Trailer Truck Co. It sells for $45 and upwards, according to load capacity, steel or rubber tires and the kind of axle.

There is only one model G, but it is made in four different sizes as far as loading capacity is concerned. The trailer with a 1000 lb. capacity has 1⅛ in. steel or rubber tires; the one with a capacity of 1300 lb. has 1¼ in. steel or rubber tires; with a load capacity of 1600 lb. the tires are 1⅜ in. steel or rubber, and they are 1½ in. rubber or steel, for the trailer carrying 2500 lb. There are two series, the first one having a D. C. axle and the second series a Timken.

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85 Per Cent Dividend for Milwaukee Exhibitors

MILWAUKEE, WIS., Nov. 1—Results from the show held by the Milwaukee Automobile Dealers, Inc., at the State fair grounds are very encouraging and the undertaking was so successful as an attraction for the State fair that the agricultural commission has offered to set aside the same building for the show next year. The show was open five days and during that time the total attendance was 40,000, of which 27,000 was paid attendance, mostly farmers; between 400 and 500 dealers outside of Milwaukee attended. The payment to the State fair for the use of the building was $3,000 and the receipts from the sale of space and tickets were $6,021 and $2,700, respectively. In consequences, a dividend amounting to 85 per cent of the cost of space was returned to each exhibitor.

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Larger Quarters for Quaker Show

PHILADELPHIA, PA., Oct. 30—Philadelphia's fifteenth annual automobile show, Jan. 8 to 15, will be held in Convention Hall, northeast corner of Broad Street and Allegheny Avenue, much further uptown than any previous event of its kind. However, there will be a floor-space of 60,000 sq. ft. as compared to 27,000 last year, when the show was held in the Metropolitan Building. No trucks will be shown.

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Warner Trailer Enters Field

BELOIT, WIS., Oct. 29—A. P. Warner of Beloit, Wis., well known as one of the founders of the Warner Instrument Co., now the Beloit Works of the Stewart-Warner Speedometer Corporation, Chicago and Beloit, has developed a light trailer truck for automobiles and is about to engage in the manufacture of the appliance on a large scale.

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Michigan Truck & Lumber Adds

HOLLY, MICH., Nov. 1—A one-story addition 70 by 176 ft. will be started at once at the plant of the Michigan Truck & Lumber Co. which, in addition to doing contract work for the Ford Motor Co. has recently closed contracts with the Buick, Hudson and Maxwell companies in Detroit and Chandler in Cleveland.

Vehement Discussion of Eight Paper

Crawford's Contentions Attacked By Indiana Engineers—Acceleration Tests on Speedway and Examination of Stripped Peugeot Provide Full Afternoon Program

INDIANAPOLIS, IND., Oct. 30—The eight-cylinder side of the eight versus twelve argument was presented last night to the members of the Indiana section of the Society of Automobile Engineers and the visiting engineers at the meeting of the section at the Claypool Hotel last night, Charles S. Crawford, chief engineer, Cole Motor Car Co., took up the cudgels in behalf of the eight-cylinder engine in reply to the arguments for the twin-six presented by Jesse G. Vincent, vice-president of engineering, Packard Motor Car Co., to the Detroit section Sept. 16, and to the Indiana section Sept. 24.

Representative Attendance

Prospects of an interesting and illuminating argument on multiple-cylinder engines together with the afternoon feature of acceleration and speed tests of eights and twelves on the speedway and a view of the Peugeot driven by Aitken at Sheepshead Bay, which was disassembled for the purpose, brought out a large and representative gathering. Every motor car manufacturing center was represented by engineers from some of the factories. Chairman Moskovics and Secretary Combs had done such good publicity work that there were in the neighborhood of 300 engineers in attendance.

Acceleration Studied

The afternoon session at the speedway proved an interesting one as twelves, eights and sixes were given tryouts for speed, acceleration and low-speed running. National twelves, Cole eights, Haynes, Marmon and Dorris sixes were put through their paces for the visiting engineers. After that they were taken to the Prest-O-Lite plant where the Peugeot racing car was torn down for their edification, as one of the best examples of motor car engineering.

Before taking up Crawford's paper, the suggestion was made by W. G. Wall of the National company that the section appoint a committee to develop a standard method for conducting acceleration tests. He stated that there were other factors than the actual time element required to increase speed from one definite point to another to be taken into consideration and cited that it was possible to cut down the flywheel weight and get very good acceleration, but the lower flywheel weight would give poor idling. He suggested that the section get up a formula which would take in such factors as wheel sizes, gear ratios, and so on, that what the owner wanted was low-speed ability as well as rapid acceleration.

In confirming this, Howard Marmon of Nordyke & Marmon stated that the owner availed himself most of the car's ability to get from one speed to another and there was needed a standard definite way to compare cars on that basis; the society should standardize the means for such comparison. He believed that the speedometer and stop watch while not giving precise results would give results sufficiently accurate for ordinary purposes.

Professor Veal of Purdue University, a member of the Research Division of the Standards committee of the S. A. E., stated that that division had been working on such a basis of comparison for some time. He said that such apparatus as the accelerometer and chronometer gave precise and satisfactory results but they were too elaborate for every-day use. He thought that the work of the section along this line would be of assistance to the Standards committee. The matter then was referred to the Research committee of the section for report next meeting.

The new section of the S. A. E., the Mid-West section, organized recently in Chicago was introduced to the Hoosier section by Darwin S. Hatch of *Motor Age*, who outlined the purposes of the new section and stated that it would not incroach upon the territory of the Indiana branch.

The Research committee of the Indiana section then presented a report of a test made that afternoon for acceleration and speed of a Cole eight. With an eight-cylinder motor, 3½ in. by 4½ in., a Cole eight car (stock model except for cord tires), the acceleration on the speedway on high gear from 10 to 50 m.p.h. was made in 23.7 seconds. This was the average of two readings, one taken in one direction and one in the other. The speed test conducted in the same manner gave 64 m.p.h. These tests were made with the windshield in operation and the top up.

With the top lowered and windshield open the Cole eight made an average of 21.5 sec. in accelerating from 10 to 50 m.p.h. The maximum speed in this instance was the same as that of the previous one. The car was geared 4 to 1, had 34-in. diameter wheels, used aluminum alloy pistons with a clearance of 0.005. These are all stock specifications. However, castor oil was used as a lubricant. With the same carbureter adjustments the car gave an average of 2½ m.p.h. on high in the low-speed test. This was done with one bad cylinder caused by a seized piston.

Crawford's paper was read by Haynan of the Cole Motor Car Co., and was entitled, "The Characteristics of the Eight-Cylinder Engine." It appears in part on page 838 to 843.

Warm Discussion Follows

In the discussion of the paper W. G. Wall of the National Co. referred to Crawford's statement, "Since in any engine, the clearances are practically the same, the noise therefrom would be substantially the same per contact; the multiplication of the parts in operation will increase the noise in the same proportion as such multiplication occurs." Mr. Wall stated that if we multiply the parts of the same size and shape this would be true, but if they are not the same size and weight, it would not be true. He illustrated this with the suggestion of a boiler shop in which a sledge was being operated slowly with a heavy blow—this representing the small number of parts, and compared it with very rapid blows from a tack hammer, leaving it to be inferred that the rapid blows from a tack hammer would be less objectionable than the less frequent and louder ones from the sledge.

In reference to Crawford's remark that while vibratory force does exist, one usually is surprised in not being able to notice it when riding an eight-cylinder car, Mr. Wall stated that he did not know whether the eight has horizontal vibration, but the eight-cylinder cars that he had noticed reminded him of a large dog coming out of a pond and shaking it-

self. He thought Crawford was right as to the heat loss being less in the eight than in the twelve on account of the area, but the loss in the single cylinder engine is still less and there are things which compensate for this loss in the greater number of cylinders. One is able to keep the pistons cooler and to use smaller clearances with the small-bore motor and higher compression with a higher mean effective pressure.

In an eight the distance from the carbureter to each cylinder is less than in the six or twelve, but Wall expressed some doubt as to how much advantage this might give for all-around use. For slow speed work it is advantageous to have a small intake pipe and mix the gases there, but the high speed engine requires a larger intake pipe and with a large pipe better mixture is essential in the carbureter.

Gas Distribution Uneven on Twelve

Replying to this, Mr. Crawford stated that on the noise comparison he was not referring to the noise per tappet, but held that the multiplication of noise was more objectionable in the twelve than in the eight. So far as even torque and vibration are concerned, there was no appreciable difference between the twelves and the eight. He remarked that it was almost out of the question on the twelve to get an equal distribution of gas, although perhaps it could be done by complicated piping which, however, might give difficulties on account of friction.

Mr. Dorris of the Dorris Motor Car Co., stated that it was his belief that the engineers in this discussion were overlooking the buyer of the car. He thought they ought to glance over their repair shop list; that there were other items besides cylinders that were giving trouble.

Loomis Attacks Efficiency Argument

A. Loomis of the Packard company, who to an extent represented J. G. Vincent, took exception to some of Crawford's calculations in the matter of balance and in the matter of evenness of torque stated that the question resolved itself into the number of impulses per unit of distance traveled, which would give Packard 1375 as against 1030 for Cole or one-third more impulses with the stock gear ratio. In regard to the complication of water piping, he stated that this was the same on the twin-six as on the old Packard six. In considering the variation in volumetric efficiency, he stated that the Packard used this argument many years ago when building "one-lungers," in prophesizing that the two-cylinder never would replace the single-cylinder. In regard to the difficulty in getting the parts equal in weight, and the increase in this difficulty with the increase of the number of cylinders, Loomis admitted that this is difficult, but Packard is doing it on a commercial scale. Referring to Fig. 15 showing Crawford's suggested counter weights he stated that anything that increased the weight of the reciprocating parts increased the vibration and the increase of the counter weight was analogous to an increase in weight of the pendulum in a clock, which would slow it down.

Three Miles Not Low Enough

It is possible to find a lower limit to the desirable speed on high gear and the 3 miles suggested by Crawford could not be considered such a limit. Also there is always a limit to the frequency of the noise, but that limit is when it goes beyond the musical range. The twin-six frequency of noise is not high enough to be objectionable.

As to the accessibility of the steering gear, he stated that the Packard frame width was much less than that of the Cole, and contended there must be more difficulty in placing a steering gear with a 90-deg. motor than with a 60-deg. one. In conclusion, he said that performance is more than structural economy and that after an owner had driven twin-sixes no smaller number of cylinders would be satisfactory.

In refutation, Crawford stated that the 3-mile speed limit was set because it was expected every owner would get that and that he has obtained 1½ m.p.h. on high. He did not feel that engineers of twelve-cylinder cars have had proper experience with the eight, that the latter had been in the hands of owners for a year, and that when the twelves have been in owner's hands that time, difficulties will crop up that are not known of at present. He expects considerable variation in valve clearance in the twelve as there has been some in the eight and the difficulties from this point should upset the twelve more than the eight.

Mathematics of Noise

Alanson P. Brush, consulting engineer gave it as his belief that the twelves and the eights were equally good if kept in the best range of their adaptability; that for any speed range there is a critical cylinder diameter which will give best results, and that this factor is the one that should determine the number of cylinders. He believes that this critical diameter ordinarily is less than the 3½ in. mentioned.

In discussing the noise question, he developed the fact that if an engine be multiplied, all of its parts, exactly in proportion, *its kinetic energy will increase as the fifth power of the line dimensions*, that tappet impact decreases as the number of cylinders is increased. He repeated the statement that *quietness is continuity of noise* and that the impact is lighter on a twelve as the tappets are lighter and the energy of the blow is very much less. For the same power the *smaller valve parts of the eight and still smaller ones of the twelve should make upkeep actually less than for motors of a smaller number of cylinders*, if equally well designed and made.

The Placing of Accessories

Professor Veal stated that in his opinion it was harder to place accessories on the eight than on the twelve without lengthening the hood.

Mr. Heinze of the Heinze Electric Co., and formerly designer of the Northway engines, corroborated Brush's statement that there was a certain size of bore and stroke which gave highest thermal efficiency, but disagreed with Brush when he said that he thought this was greatest in a cylinder 4¼ by 5¼. This fact, however, he did not consider the most important consideration for the buyer, who is buying for the smoother running qualities of the eight and twelve. The smaller number of cylinders would give fewer parts but durability is more to be desired. Though the thermal efficiency was decreased with the increase in the number of cylinders, the public wanted even torque and less noise and that objectionable noise is heavy impact, so that *the more cylinders the less noise*. He said that engineers, whether they knew it or not, throughout the entire industry were striving toward the gas turbine. He thinks the limit is not reached in the twelve-cylinder.

Turbine Should Be Simple

Mr. Bull of the Cole engineering staff stated that it was not only the continuous torque of the gas turbine that made it desirable, it was its simplicity, consequently too many cylinders decreased simplicity. On frame width, he said the Cole size was the S. A. E. standard width and there should be no objection to a width already standardized.

Four Never Fully Developed

Mr. Crawford, in closing, stated that the four never had been developed in this country, that before it was brought to its highest point it was ditched for the six; that the two best motors for thermal efficiency and all-around efficiency ever built were the Sunbeam and Vauxhall, four-cylinder motors which, though they have different bore-stroke ratios have shown better efficiency than any others regardless of the number of cylinders.

Factory Miscellany

Weston-Mott Adds—Alterations which will cost at least $5,000 will be made at the plant of the Weston-Mott Co., Flint, Mich.

Work on Continental Plant Started—Work has been started in the new drop forge steel plant for the Continental Motor Mfg. Co., Muskegon, Mich. The structure will be 180 by 60 ft.

Gryphon Tire Buys Land—The Gryphon Rubber & Tire Corp., New York City, has acquired title to a plot of land, 250 by 103 ft., in the west side of Bailey Avenue, just north of 192d Street. The property also fronts on the tracks of the New York & Putnam Railroad.

Brewers to Make Tanks—American Brewers & Bottlers Specialty Co., Fourth and Windlake Avenues, Milwaukee, Wis., has entered the automobile field, and is specializing on gasoline tanks, its equipment being especially adapted to handle this class of work.

To Make Valve Grinder—The Just Specialty Co., Syracuse, was dissolved Oct. 15 and a new company styled Universal Equipment & Supply Co. formed to take its place. The new concern will manufacture and distribute a number of accessories including the Simplicity valve grinder formerly produced by the Just company.

Davis Co. Moves—Davis Manufacturing Co., Milwaukee, Wis., has abandoned its old plant at Fifteenth and Park Avenues and removed its entire equipment to its new plant at Fifty-seventh Avenue and Mitchell Street. The Davis company specializes on large motors for tractor purposes, although building to some extent motors for the automobile trade.

Crown Fender Plant in Ypsilanti—The city council has voted to turn over the Gaudy property to the Crown Fender Co., which has been negotiating with the Industrial Association for some time to locate here. It is provided that if no factory building is erected on the site within two years the Industrial Association is to reimburse the city or return the deed.

Federal Bridge Tests Tractors—The Federal Bridge Co., Waukesha, Wis., is now building tractors for several different companies, and each day the plant is the scene of a novel test. Two tractors with steering gears set run for hours continuously, without the attention of a driver. In this way the tractors are given a practical road test and are examined at intervals only to see that they are working satisfactorily.

To Make Springs—The Jenkins Vulcan Spring Co., St. Louis, Mo., has incorporated for $40,000, to make and deal in automobile leaf springs and accessories. The company has taken over the stock of the Jenkins Manufacturing Co., St. Louis, maker of the Vulcan spring. The officers of the new company are T. B. Jenkins, president; J. F. Jenkins, vice-president and secretary, and R. G. Zetrouer, treasurer and manager.

Dort Acquires Land—Land valued at $40,000, located west of the Dort Motor Car Co., Flint, Mich., has been acquired by J. Dallas Dort, president of the company, to provide for future expansion. The property comprises about 75,000 sq. ft. of ground. No buildings will be erected for the present time on the land, but it is expected that with the growing business the Dort company will start some building work early next year.

Ford Addition in St. Louis—The Ford Motor Co. will add a $300,000 building to its St. Louis branch, which will be ready by April 1. This building will duplicate the original building erected two years ago at Forest Park Boulevard and Sarah Street. The new building, fronting on Forest Park Boulevard, will cover a lot of 150 sq. ft. and will adjoin the site of the original building. It is to be fireproof, of brick and reinforced concrete construction.

Reo Truck Buys Bldg.—The Reo Motor Truck Co., Lansing, Mich., has purchased the large structure known as the Lyon Tabernacle, which has been used by Dr. Lyon. The truck business has been so exceptionally large that additional room had to be provided at once, although additions to the truck plant are under way. However, conditions have been such that much work has been going on on the grounds outside the plant and where neither the workmen nor the material and trucks were under shelter. It was principally to overcome this that the tabernacle building has been purchased.

The Automobile Calendar

Nov. 12-20.....Providence, R. I., Show, State Armory, Rhode Island Automobile Dealers' Assn.
Nov. 18.....Arizona 150-mile Grand Prix.
Nov. 18.....New York City, S. A. E. Met. Sec. Meeting.
Nov. 22-27.....Binghamton, N. Y., Show, State Armory, Binghamton Automobile Dealers' Assn.
Nov. 29-Dec. 4....Electric Prosperity Week.
Dec. 5.....Worcester, Mass., American Road Builders' Assn. Day.
Dec. 6-11.....Springfield, Mass., Show, Auditorium.
Dec. 31-Jan. 8....New York City, Sixteenth Annual National Automobile Show; Grand Central Palace; National Automobile Chamber of Commerce.

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Jan. 3-9.....Importers' Salon, Hotel Astor.
Jan. 5-6.....New York City, S. A. E. Winter Session. Standards Committee Meeting.
Jan. 7, 8, 10, 11...New York City, Convention National Assn. of Automobile Accessory Jobbers.
Jan. 8-15.....Cleveland, Ohio, Show, Wigmore Coliseum, Cleveland Automobile Show Co.
Jan. 8-15.....Philadelphia, Pa., Show, Philadelphia Auto. Trade Assn.
Jan. 17-22.....Rochester, N. Y., Show, Exposition Park. C. A. Simmons, Mgr.
Jan. 18-22.....Lancaster, Pa., Show, Conestoga Park Pavilion.
Jan. 22-29.....Chicago, Ill., Show, National Automobile Chamber of Commerce; Coliseum and First Regiment Armory.
Jan. 24-29.....Buffalo, N. Y., Show, Buffalo Automobile Dealers' Assn., Broadway Auditorium.
Jan. 29-Feb. 5....Minneapolis, Minn., Show, National Guard Armory, Minneapolis Trade Assn.
Feb. 7-12.....Kansas City, Mo., Show, Convention Hall, Kansas City Motor Dealers' Assn.
Feb. 14.....Des Moines, Ia., Show, Des Moines Auto. Dealers' Assn.
Feb. 15-20.....Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 19.....Newark, N. J., Show.
Feb. 20.....Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26.....Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 29-Mar. 4....Fort Dodge, Ia., Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 4-11.....Boston, Mass., Car and Truck Show, Mechanics Bldg.
May 13.....New York City, Sheepshead Bay Speedway Race.
May 30.....Indianapolis Track Race.
June 17.....Chicago Track Race.
June 28.....Des Moines, Ia., Track Race.
July 4.....Minneapolis Track Race.
July 4.....Sioux City Track Race.
July 15.....Omaha, Neb., Track Race.
Aug. 5.....Tacoma Track Race.
Aug. 18-19.....Elgin Road Race.
Sept. 4.....Des Moines Track Meet.
Sept. 15.....Indianapolis Track Race.
Sept. 16.....Providence Track Race.
Sept. 30.....New York City Sheepshead Bay Race.
Oct. 7.....Omaha Track Race.
Oct. 14.....Chicago Track Race.

The Week in the Industry

Westlake Joins Philadelphia Ajax-Grieb—W. A. Westlake has joined the Ajax-Grieb Rubber Co., Philadelphia, Pa.

Turner N. Y. Saxon Mgr.—H. C. Turner has been appointed manager of the Saxon Motor Car Co., New York City.

Hurd Heads Portland White—R. S. Hurd is the newly-appointed head of the White factory branch in Portland, Ore.

Cowan Sommer Office Mgr.—Harry Cowan has been appointed office manager of the Sommer Motor Co., Bucyrus, Ohio.

Jackson Empire Sales Head—W. E. Jackson has been appointed manager of the Indiana Empire Sales Co., Indianapolis, Ind.

Swap Service Mgr.—Frank Swap has been appointed service manager of the More Automobile Co., St. Louis, distributor for the Marmon.

Payne with Gibson—J. H. Payne has been appointed manager of the automobile department of the Gibson Automobile Co., Indianapolis, Ind.

Riley Heads K. C. Assn.—The Kansas City Motor Car Dealers Association has elected N. S. Riley, president; W. J. Brace, vice-president, and E. E. Peake, secretary and treasurer.

Marshall Buffalo Mgr.—G. J. Marshall is now manager of the Buffalo (N. Y.) office of the McGraw Tire & Rubber Co., East Palestine. He succeeds C. H. Connelly, who goes to Kansas City for the company.

Schwab and Beckler Leave Gemco—W. H. Schwab, formerly sales manager of the Gemco Mfg. Co., Milwaukee, and C. W. Beckler, formerly advertising manager of the same concern, have severed their connection with the Gemco company and become interested in the Auto Parts Mfg. Co., 528 Broadway, Milwaukee, Wis.

J. B. True, Jr., has been appointed director of sales of the Gemco Mfg. Co. Mr. True has had wide experience in merchandising and advertising and will handle the advertising as well as the sales department of the Gemco company.

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Dealer

St. Louis Chevrolet Makes Lease—The Chevrolet Motor Car Co. of Missouri, St. Louis, recently incorporated, has leased the new two-story building forming the western tip of the Lindell Locust Cutoff, which it will use for office headquarters of the company.

Motor Men in New Roles

Join Sun Co.—J. L. Larkin and H. A. Minturn have become actively connected with the Sun Motor Car Co., this city, and take up their work at once.

Horton Appointed Mgr.—G. A. Horton has become manager of the automobile painting department of the Great Western Motor Car Exchange, St. Louis, Mo.

Corn Detroiter District Mgr.—B. J. Corn has been appointed district sales manager of the Detroiter Motor Car Co., Detroit, Mich. His territory covers Indiana and Kentucky.

Greig Joins Dunlap-Ward—C. N. Greig has joined the Dunlap-Ward Advertising Co. of Chicago and Detroit. Mr. Greig will be a vice-president and his headquarters will be at the Chicago office.

Fuess Returns to St. Louis Co.—E. J. Fuess who until recently had been connected with the Frye Motor Car Co., St. Louis, has rejoined that company and will manage its used car department.

White a Purchasing Agent—J. F. White has been appointed purchasing agent of the Anderson Forge & Machine Co., Detroit, Mich. He was formerly in a similar capacity with the Metal Products Co.

Bartlow Makes Change—V. A. Bartlow, formerly in charge of the Bosch service station at San Francisco, will assume charge of the Spokane service station for the Inland Empire at the Child, Day & Churchill Co.

White Leaves Pierce-Arrow—H. C. White, formerly superintendent of the assembling departments of the Pierce-Arrow Motor Car Co., has accepted the position of production engineer with the Curtiss Aeroplane Co., Buffalo, N. Y.

Jossman Columbia Truck Mgr.—Henry Jossman has been appointed sales manager of the Columbia Truck & Trailer Co., Pontiac, Mich., which recently moved to this city from Kalamazoo. Mr. Jossman was formerly connected with the Oakland Motor Car Co.

Thompson Makes Change—B. D. Thompson has been appointed production manager of the Curtiss Motor Co., Hammondsport, N. Y. Mr. Thompson was until recently machine-shop foreman of the National Twist Drill and Tool Co., Detroit, Mich.

Viot Joins Continental Motor—H. R. Viot has become director of purchases of the Continental Motor Mfg. Co., Detroit, Mich., and will look after the purchases for both the local and Muskegon plants. Mr. Viot was formerly purchasing agent for the Oakland Motor Car Co., Pontiac.

Beatty Goes to Providence.—S. M. Beatty has been transferred by the Goodyear Tire and Rubber Co. from the managership of the branch at Providence, R. I., to a position at the factory in the sales promotion department. He is succeeded by E. J. Smith, who had been manager of the branch at Hartford, Conn.

Eastman Philadelphia Packard Mgr.—Lee J. Eastman, who was assistant to E. B. Jackson when the latter was head of the company in Philadelphia, Pa., has been appointed manager of the Packard Motor Car Co., Philadelphia. Mr. Eastman had been acting manager of the Packard company there since Mr. Jackson's removal to New York City as president of the New York company.

Houghton, Dodge Rep., Resigns.—A. E. Houghton, district representative for Dodge Brothers in the Mountain States territory, with headquarters at 1608 Broadway, Denver, who has for three months been in charge of both the Denver and Omaha districts, has been succeeded in the Denver office by his assistant, C. A. Biggs. From now on Mr. Houghton will make his headquarters in Omaha exclusively and concentrate his work upon the larger territory handled from that point.

Buick Managers Form Oakland Co.—Robert H. Martin, manager of the Buick branch in Washington, D. C., for three years, has resigned. With A. G. Southworth, Brooklyn, and A. H. Salver, Buick manager in Pittsburgh, he has formed the Southern Oakland Co., and will be wholesale distributor of Oakland cars in Georgia, Alabama, Florida, Mississippi, Tennessee, South Carolina and western North Carolina. The officers of the company are A. G. Southworth, president; A. H. Salver, vice-president, and R. H. Martin, secretary-treasurer and general manager. The company's headquarters will be in Atlanta.

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Dealer

Hartford Tire Pump to Add.—Plans for the factory and garage of the Hartford Auto Tire Pump Co., Hartford, Wis., have been revised to provide just double the space originally planned. The building will be of reinforced concrete and hollow tile, 55 by 88 ft., two-story and basement. Work is now under way.